THE

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ELECTRICAL REVIEW.

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1911 EDITION

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OUR FOREIGN ELECTRICAL TRADE.

WITH the publication this week of the foreign trade returns for the month of December, we now have before us the complete statement for the past year. The figures show that the period has been a record one as to value, both in imports and exports, better than the best preceding "boom year," viz., 1907, when imports were only 646 millions sterling, against 678½ millions in 1910, and exports were only 426 millions sterling, against 430½ millions in 1910. In studying the comments of the daily Press, we observe that papers that are similar as regards political views are not altogether agreed on the effect of value and volume upon the year's figures. For example, an article which announces in one sub-title that the increase in our foreign trade was 106 millions, adds another to the effect that it is "largely due to higher prices," and quotes rubber and tin as two items of imports where the difference in value runs into millions (*Daily Telegraph*); while a second newspaper says that, so far as the December returns are concerned, the increase of 13·7 per cent. in imports, and that of 10·75 per cent. in exports value, are due for the most part to a genuine increase in the actual turnover, "higher prices only playing a comparatively small part" (*Standard*). The *Times* dwells upon the same point, instancing meat and cotton to show that much of the increase is only "apparent" and is "due to the rise of prices," this giving the writer an opportunity for mentioning that while the state of employment is better than it was both in 1909 and in 1908 "unemployment does not subside as it used to, and as it does in other countries in good times."

Apart from any adjustments which may be required for variations in prices, whether higher or lower, which it is quite right to take into account in our efforts to gauge the exact position, we observe that the boom year of 1910 seems likely to be bettered by 1911. "The economic omens are still favourable, and matters should improve in the regular course as the spring advances" (*Times*).

Turning now from the general results which only come within our province in so far as they indicate all-round trade improvement, which is so great a help in producing greater activity for electrical engineering trades, we may refer more fully to those with which we and our readers are directly concerned.

We glean the following from the returns:—

Electrical Goods and Apparatus.

Imports in December (month) increased by	£51,818.
Exports " " "	£315,848.
Total increase of exports for the year ...	£1,887,041.

It is impossible to say what proportion of this increased export of nearly two millions is due to higher prices, but we know that British electrical manufacturers in all parts of the country have been busier than in any previous year in

electrical exportation. From their point of view the figures have represented greater business activity chiefly, and only as to a small proportion, we believe, do they reflect higher prices of finished electrical manufactures, due to higher prices of some of the materials necessary in their production.

Glancing aside for a moment here, there are some other 1910 increases in exports which concern our readers everywhere. They are given as follows :—

Iron and steel manufactures exported advanced by		£4,810,795
Other metals	,, ,,	£1,651,214
Machinery	,, ,,	£1,239,078
Railway carriages, motors, &c.	,, ,,	£1,289,559

"After making all allowances," says a contemporary, "the country's foreign trade has undoubtedly gone ahead with another big stride." Its progress during the last 10 years is shown in a table which we reproduce here :—

	Imports.	*Exports.*	*Re-exports.*
1910 ...	£678,440,173	£430,589,811	£103,776,104
1909 ...	624,740,517	378,379,444	91,365,465
1908 ...	593,140,723	377,219,579	76,665,589
1907 ...	645,904,176	426,035,083	91,942,084
1906 ...	607,888,500	375,575,338	85,102,480
1905 ...	565,019,917	329,816,614	77,779,918
1904 ...	551,038,628	300,711,040	70,304,281
1903 ...	542,600,289	290,800,108	69,573,564
1902 ...	528,391,274	283,428,966	65,814,813
1901 ...	521,990,198	280,022,376	67,841,892

As the above figures carry us back over a period of 10 years, we have glanced at the figures of Electrical Exports appearing in our own pages for the last five weeks in 1901. These (including three days in November) amounted to a little over £75,000, the chief items being for telegraph cable and apparatus. A modest figure, indeed! For the month of December, 1910, the electrical goods and apparatus exported reached the excellent record of £605,278. We make no deduction from this, except that which everybody knows, namely, that this past decade has witnessed the beginning of wonderful electrical development in many parts of the earth, while it has, at any rate in its last five years, brought our manufacturers less activity for public electrical undertakings at home, enabling them or compelling them—whichever way we choose to regard it—to devote greater attention to the electrical needs of foreign parts. We have said above that it is the *beginning* of foreign electrical development that we have been observing. We adhere to that description of the position. The greater attention given to the matter during the past couple of years has brought a splendid increase of electrical trade, but it is to our way of thinking only a foretaste of still better things to come. We have passing through our hands at the present moment, reports which strengthen us in this conviction. What South America and Australia, Africa and India, China, Japan, and Russia, will require during the next 10 years if electrical progress is permitted to proceed at its present, or its promised accelerated pace, almost defies us in our attempts at imagining. In a sentence, the heart of the commercial man, who is gifted with a fair share of imagination, ought to leap at the prospect!

Our manufacturers are undoubtedly making greater effort to secure a share of this business. Therefore, it may be they wonder sometimes why it is that we publish our own and other's complaints that they are letting opportunities slip past them purely for the want of seeing and embracing these opportunities when they occur. In various parts of the world—Australia and Canada are two cases standing out prominently—there is a sort of Macedonian cry: "Why does the British manufacturer not come and take the business which we have to give him, and which he can easily secure if he will only take trouble." This taking trouble, we are aware, may mean a great deal in regard to the particular requirements of particular markets, but does it not seem strange that there should have to be formed organisations whose one object is to *induce* the British manufacturer to pay greater attention to the needs of certain countries?

The Institution of Electrical Engineers opened its meetings this session with an epoch-marking address which has set men thinking along more hopeful lines than some were wont to do—but that brilliant forecast of the future only related to the application of the "All-Electric Idea" in these tight little islands. It requires considerable ability at adaptation to apply it to foreign countries and to the whole world, but if it will only encourage us as manufacturers, as foreign-trade seekers, as those who go down to the sea in ships to bring business to the factories at home, to get a larger vision of the fields that are opening out electrical possibilities for us everywhere, it will have done much to help us in the intervening years 'twixt 1910—the year of the prophetic Ferranti address—and the day when the present youngest members of the electrical trade and profession may witness the realisation of the president's dream, or at any rate some parts of it.

What News from Australia?

After what we have said in the course of the preceding article, some of our readers will probably be little surprised by the following dispatch :—

German Competition in Australia.

Sydney, *January 5th.*

At a meeting of representatives of British commercial firms in the Commonwealth, presided over by Mr. Weekes, the British Trade Commissioner, it was decided to form an association to foster British trade and to further the interests of British manufacturing and distributing houses and their branches and agencies in Australia. Captain Strahan said that German firms were undermining British enterprise in Queensland and the East.—*Reuter.*

How far *commercial* firms is to be taken as including *electrical* we cannot say, but if this report has any reference to British electrical manufacturers and traders, it surely can only be because our works are too busy to bother themselves. And yet can that be so, for are there not authorities amongst us who say that what we want is sufficient work to keep our factories employed to their full capacity—then we shall no longer undercut each other? If the paragraph applies to electrical men, and electrical factories want more work, because more work is the only way to look for improving prices failing agreement among manufacturers, why do we not go and seek the work without requiring this pressure from an Australian commercial association? Can it be that there are other reasons? Why are German manufacturers undermining British enterprise in Queensland and the East? We have heard it said before, and now we read it again in a message from men who are engaged in the fight every day. We have also heard it from the lips of Australians visiting this country that one of the finest opportunities there, seeing the character of the enterprise in prospect, lies along the electrical way.

We know that German electrical firms are very active in Australasia—are we correspondingly so? Apparently not. Are we as active as we ought to be, or do we reduce activity in the belief that a modest sort of preferential treatment—which is sometimes, we are afraid, more nominal than real—makes up for the deficiency? Even the United States, which does not worry itself greatly with export trade nowadays, and does not, generally speaking, try to adapt itself even as much as we do to the needs of other countries, especially in the matter of finance, is notably on the alert in Australia and New Zealand, and has been for years. Witness the amount of American electrical plant and other manufactures which find their way there. Why is it—we are seeking for information—that British electrical manufacturers are not doing more there than they are? Have they lost faith in the market? Or, as they are doing more than they once did, is it supposed that there is little else worth worrying about? The recent Lithgow small-arms factory installation contract, as will be remembered, inclined us to write plainly regarding the course pursued in giving out this particular piece of work, but that failure must not be taken too much to heart, for there is a good deal of electrical work given out by others as well as by Government departments. So little done, so much remains to do.

We are glad to observe that one of our Australian exchanges is protesting, on behalf of firms not resident in the country, against too short a time being allowed by Governments and Corporations advertising for tenders. The *Australian Mining Standard* writes regarding that tendency and its effect on firms who might be prepared to quote if there were sufficient time allowed for consulting authorities at home, in the following terms :—

> If it is intended by Australian Governments and corporations advertising for tenders that makers of goods outside the Commonwealth are to be consulted at all, time should be allowed to consult them properly. The effect of allowing insufficient time is that many British and other firms will not take the risk of tendering largely in the dark as to the details of proposed work. In the case of the tenders for electrical machinery for the State coal mine in Victoria, in the aggregate sufficient time has been allowed to do what is requisite, but the matter has been so humbugged that it is more than probable some of the best manufacturers will not send in offers. In the first instance, only a little over three weeks was allowed. That time being obviously insufficient, the agents of several home firms wrote asking whether there would not be an extension. In one special instance no reply was received to this inquiry. Then, later, very near the date when the tenders ought to have been in, an unsolicited intimation was received that there would be an extension of time to what was about the proper period to have fixed in the first place. This method of doing business, of course, leads people to "turn down" a proposed contract at the outset, as impracticable to quote for on the ground of want of time, only to find that after they have dismissed the matter from their minds and have got thoroughly out of gear on the subject, by a stretching of possibilities, they may still be able to tender. Such treatment of course is thoroughly exasperating, because even when by superhuman efforts and the expensive use of the cable the situation is saved, a greater risk than ought to be necessary is incurred in making up prices without absolutely full knowledge.

If the proposed association of commercial men referred to in the Reuter dispatch appearing at the beginning of these notes would see to it that such disadvantages as are mentioned here by our contemporary, and as have on several occasions been named by the ELECTRICAL REVIEW in connection with Canadian public contracts, were removed, they would probably be assisting British electrical engineering industry in a practical manner, which could not fail to lend greater force to their appeal to British firms to devote themselves more energetically to the exploitation of Australian trade possibilities.

The shortness of tendering time, however, gives rise again to an oft-reiterated piece of counsel, which is this, that we must be so represented in other countries that business can be transacted, quotations given, and orders booked, with an absolute minimum of "reference home" operations. Organisation and *personnel* must both be the best that are available ; it seems that this point cannot be too often urged as matters stand.

New Zealand's Water-power.

RECENTLY we drew attention to the ambitious proposals of the New Zealand Government for establishing State-owned hydro-electric plants in various parts of the Dominion. The Bill, known as the "Aid to Water-power Works Bill," has now passed into law in an amended form. It originally authorised the Government to carry out nine schemes for developing some 72,000 H.P., at an estimated cost of 2¼ million pounds, and asked for authority to raise half a million pounds per annum for four years to defray the cost, in part. The monetary portion of the Bill has become law, but as the result of much-needed criticism, initiated by Mr. Frederick Black, a consulting engineer, of Wellington, the nine schemes were reduced to three, each estimated to develop 10,000 H.P. and cost some £300,000. These are Kaituna—to supply Auckland city and a large tract of thinly-populated country ; Lake Coleridge—to supply Christchurch and another large tract of agricultural country ; and a third one not definitely chosen, but in all probability Hutt—to supply Wellington city and one or two small townships near by. The population of Auckland is about 90,000 ; of Wellington, some 70,000 ; and of Christchurch about 55,000. Each locality already possesses an electric lighting and tramway undertaking and ample supplies of good coal, costing from 17s. to 23s. per ton, so that the Government schemes would of necessity come into competition with these municipally-owned undertakings, assuming, what is by no means certain, that energy can in these cases be delivered from a water-power plant over a considerable distance—Kaituna to Auckland, for instance, 130 miles—at a price which will enable it profitably to compete with steam-generated power.

There appears to be a widespread and unfounded belief that hydro-electric power costs practically nothing to produce and very little to transmit, whereas experience conclusively shows that this is far from being so—that, in fact, a modern steam generating plant practically on the spot, and operating with fuel of moderate cost, can sell cheaper than a hydro-electric plant situated at a distance, mainly by reason of the proportionately heavier, and often unforeseen, capital charges entailed in the latter class of work.

It is somewhat astonishing to find, during the debate in the New Zealand House of Representatives, the Premier instancing "a proposal to transmit power 300 miles between the Victoria Falls and Johannesburg, at a proposed expenditure of £3,000,000," among other schemes, as showing the practicability of long-distance transmission. This was a singularly unfortunate reference, for apart from the misstatement as to distance, which should be 700 instead of 300 miles, it is well known that the Victoria Falls and Transvaal Power Co. has adopted the much safer expedient of equipping three new steam-turbine stations on the Rand, while a fourth is in prospect at Vereeniging, and presumably others will follow in connection with allied schemes. Almost all the important hydro-electric developments in Europe and America have come into existence either on account of the dearness of fuel in the localities served or because there was established, or to be established, an industry near by.

Now, while we have the Premier's word that the New Zealand proposals are based upon absolutely reliable data, we find absolutely nothing in the published debates to indicate the probable cost of energy delivered on the market, and not even an estimate of the possible extent of the latter—in fact, these all-important points appear to have escaped attention, for we gather that the cost of transmission in the case of the Lake Coleridge scheme had not even been estimated at the time of the debate.

That the future of industrial New Zealand is bound up with the development of her State-controlled water power, we do not for a moment doubt. The few facts and figures disclosed, however, are sufficient to justify the very strong local criticism which has been directed against the Government scheme, mainly because its proposals are premature and based on misconceptions both as to cost and as to utility. For this reason we are glad to know that since the passing of the Bill a strong effort has been made in support of a proposal to restrict the Government's ambition to the Lake Coleridge scheme, that being the most suitable development on which to gain preliminary experience as to costs and commercial results before other large and costly undertakings are entered upon.

Engineering Trade, 1910 and 1911.

IN its *Engineering Supplement* for Wednesday last, the *Times* publishes a full review of the progress of the various sections of the British engineering trades during last year. One feature consists of the collection of reports from 150 firms, many of them electrical, on the outstanding features in their experiences of the 12 months. From almost every direction comes the report of increased activity, in some cases calling for works extensions, and the principal cause of it all is the growth of business received from Colonial and foreign markets. New branches have been opened and new connections established, and these are bearing fruit and may reasonably be expected to do so to a greater extent in this and succeeding years. No more complete justification can we desire of the ELECTRICAL REVIEW's Foreign Trade policy than the course that business has taken in 1910.

In its leading article relating to these reports the *Times* concludes that they establish "the fact that trade was better last year than it has been for some time, and that the prospects for 1911 are very promising from the point of view of the British engineering trades."

METERS.

By "GRYPHON."

I think I am fairly correct when I give it as my opinion that the managers of electric supply undertakings look upon meters as necessary nuisances. This view will obtain chiefly in the case of those who look after small concerns, where the services of a well-trained meter staff cannot be had, owing to the expense.

No doubt the same will apply equally to small gas undertakings, as gas meters have their troubles as well as electric meters—at least, so I understand.

Still, in justice to meter manufacturers, I will admit that their products are often treated with as little consideration as are batteries; or, rather, they are expected to do their duty under, at times, very trying circumstances, and the treatment is rather negative than positive—rather cavalier than kindly.

Moreover, the test room is often fitted up very roughly, the meters stocked in a slovenly manner, and the whole place thick with dust.

If the mains "super" be a man of mettle, he will insist on the jointer's mate or some general outside help sweeping out the test room once a week; if he be cleanly inclined, he may even range the meters on shelves and dust around himself. More often than not, the mains man has his hands full, especially if he does a little canvassing, and he has no time to keep the meter room snug and tidy.

It is very nice to see meters ranged round a room in good order, tested, certified and ready to hand when wanted; each meter with its card in a drawer in the office, each card bearing its maker's name and number, and the supply company's number, its record, good or bad, and its changes of location.

I once had the pleasure of starting a card system for meter bookings to replace a cumbrous and ill-kept meter stock-book. I had the pleasure, I say, of wading through frowsy and bethumbed meter books—the stock book being, I found, not reliable—in order to trace with infinite care the wanderings of a meter, till I finally reached the first entry and the date it had been received from the makers; this last, of course, was recorded in a "goods received" book of doubtful respectability.

It was a tedious task and a difficult one. Sometimes a meter on going for repairs never returned—it was replaced by one of another number; some of the demand indicators were regular puzzlers, due to the fact that in course of time their numbers became hard to decipher, and different meters readers had different opinions on the subject of the figures marked on them.

By guessing here, and comparing there, much as did the Abbé Faria in the case of the torn fragment of the will, I was able at last to feel satisfied that I had got the collection of cards fairly accurate; that, in short, with moderate certainty I might affirm that this or that card represented the history of this or that meter.

I completed the job, and it remains to-day a monument of perseverance; it is kept up to date, too, and the cards are wearing that workmanlike look of dirtiness that comes from frequent handling with unwashed hands, for we cannot be always washing our paws in these small stations, you know.

It is pathetic to note that many of the cards refer to meters on the retired list, meters plain and meters slot, meters whose useful course is run.

A solid phalanx of cards at the back or retired end of the case refers to demand indicators, now sold to a dealer for a fraction of their former value, the date of disappearance from stock being duly recorded.

With regard to the booking of meter readings, no doubt something may be said for the system of using cards—a loose-leaf book, in fact—though neat meter books of handy "pocket" size are not to be despised, if they are well indexed and the sequence of consumers rearranged with the start of a fresh book every year.

To my mind the important thing is to take frequent readings of meters on consumers' premises; ordinary consumers, at least twice a quarter at regular intervals, and large consumers once a month, or even more frequently in the case of power consumers of any size.

It is most humiliating to get a number of doubtful readings to deal with at the end of a quarter, and though in dealing with these "queries" you may be as courteous and obliging as you like, the consumer whose account you have to adjust, or the consumer whose readings you have to estimate, is liable to view his little bill for current with suspicion ever afterwards—if he still remains on the lists.

Now, if you take one or two readings through the quarter and compare them with similar readings taken in the corresponding quarter of the previous year, you may anticipate to a great extent, doubtful readings at the end of the quarter; at least you have a chance of doing so if you like to take it.

The advent of the metal lamp has, to a certain extent, rendered comparisons less easy, till the consumers have settled down a bit, but still, one can make due allowances for such changes; and what more easy than to make a rough test of the meter on the spot, or better still, insert another new or freshly tested meter in series and call again in a fortnight's time.

If you find that the two meters agree within the usual limits, a load is off your mind, and you can look forward to rendering the quarterly bill with equanimity. Moreover, the fact that you have taken the trouble to put a test meter up so that he himself can compare the readings, may, and often does, affect a consumer very favourably towards the undertaking.

When the reverse occurs and the old meter is undoubtedly at fault, you will have plenty of time to nip it out and insert another, or leave the check in till the quarter end; and the shorter periods of time you are dealing with render it more easy to hit the mark when it is necessary to make an estimate of the consumption.

In the case of power consumers whose consumption is relatively large, I think it most advisable not only to take frequent readings, but to permanently insert one or two checkmeters, and take the mean of their readings, also testing them from time to time.

Those engineers who are in the happy position of supplying power for traction purposes are finding out that it is not always safe to stick to one make of meter, but is better to mix two or three on the traction board, or wherever they meter the units supplied to the tramway authority or company.

I do not suggest that any one make of traction watt-hour-meter is necessarily more accurate than another on varying loads, though this may possibly be so, but I do say that there may be, and often is, a considerable variation in the registry of traction units by meters of different makes, on loads such as our humbler tramway undertakings provide.

The same meters may swing or turn, so to speak, on a steady load every one of them in time or speed with each other, at any rate within the usual limits of accuracy; but put 'em in circuit on a small traction load, and oh, lor! Which reading must we take as the correct one?

Safety, as usual, I take it lies in a middle course, and so we should try and select such types of meters that the one of greatest enthusiasm is pitted against the one of least, and take the mean of their opinions—probably the tramway manager will pin his faith to the laggard, at least he will if he is human, and fret about it if you render the account on the mean.

We all dislike the term units "unaccounted for," we and our masters. It is a miserable term; it implies inefficiency; it condemns us to weary explanations, and I am afraid, in some cases, to the doctoring of figures, judging by the strangely small amount of units "unaccounted for" one comes across sometimes in published accounts.

One very good reason for the swelling number of these unproductive units is the practice that obtains in a good many stations of giving rather a high voltage at the feeding points. This taking an elevated view of the declared pressure has its disadvantage, over and above that due to the fact that our ampere-hour meters ignore our generosity in volts. If by chance we give the consumers the correct voltage they, the consumers, are at once up in arms, and treat our supply with the same contempt as cabby treats his legal fare.

Of course, I am aware we must allow for the drop in the distributors, and that we cannot afford to multiply our feeding

points and interconnections *ad lib.*, still, perhaps, it would have been better to advise consumers distant from the centres of distribution to insert lamps of a somewhat lower voltage than the normal, rather than in order to give them their due, to be too lavish of volts to their more favoured fellow consumers.

Makers of metal-filament lamps evidently know of this little practice, for they always advise the putting in of lamps suitable for a higher voltage than that of the declared pressure.

In connection with meters, an amusing incident occured to a friend of mine some years ago.

His chairman, so he told me, rung him up one day on the telephone, and asked him to call upon a certain consumer, who was in a state of rage about his account, and justly so, for it was about 300 per cent. higher than that of the corresponding quarter in the previous year. The engineer plucked up courage, and called on the consumer, who was in a very bad way—a very bad way indeed.

My friend used all his tact, called down maledictions on the head of the meter clerk (peacefully working at that moment a mile away at the generating station) for not noticing the sudden jump up of consumption, and inserted a check meter in circuit; he called again in a week and both meters tallied exactly, but the amount registered was in proportion to the readings of the previous year, and not to the preposterous ones so rigorously queried.

The matter had to come before the Finance Committee, so, as he told me, his course was clear. On the date of the Committee meeting, he arrived at the meeting with the offending iustrument tucked under his arm and set it on the table, in the midst of them.

He explained with due impressiveness that this type of meter, of which, unfortunately, his predecessor had ordered not a few, had a trick now and then of boiling over, so to speak, with enthusiasm for the undertaking, and of depositing its register of the consumer's consumption in a way neither accurate nor justifiable.

He further added that after these ebullitions it would resume its normal attitude, so that even on test this little habit could not always be detected—meanwhile would the Committee authorise the account to be estimated on the basis of the consumption during the corresponding period of the previous year? He would, he assured them, get permission from his Committee to order some meters of another make to replace the aforesaid frisky ones as soon as possible.

He did tell me that, a few months later, he had to call on this particular consumer again and use his most tactful expressions. No meter in this case, but a fire!—a fire caused by the faulty wiring of the installation—tubing, un-"earthed," breakdown of insulation on a lead, arc to a live compo. gas pipe, touching or nearly touching the tubing, and a nasty flare-up, fortunately checked in time.

I can quite believe him when he declares that he lost that consumer for a while, but eventually he was regained—a wonderful instance of what tact and keeping in touch with people will do.

I once had a funny experience with a gas meter for registering the consumption of a gas stove; the readings suddenly jumped up about 300 per cent. I complained, and the meter was tested and found correct. The meter was re-inserted, and the consumption dropped again.

When I asked the gas manager for the reason, he also put a question to me. Had I rated my women folk about their wasteful use of the gas?

I admitted I had. That, he affirmed, was undoubtedly the reason for the phenomenon, the sudden fall in consumption to the normal again.

I have never felt quite satisfied that that was the true reason; a kind of suspicion yet remains that he in his hearty way was pulling my leg when he gave me that explanation.

Hulton Colliery Explosion.—The South Lancashire Tramways Co. have subscribed £100 towards the Mayor of Bolton's Atherton Colliery Relief Fund. Many of the victims of the disaster who resided at Daubhill were daily travellers on the company's cars.

EXPENDITURE ON ELECTRICAL WORKS.

ACCORDING to the estimates which have been prepared by the various engineers acting for the companies and local authorities who have promoted Bills for consideration in the next session of Parliament, the following sums will be expended if the promoters are successful in getting their Bills through:—

TRAMWAYS.

Brighton and District Tramways Bill	£89,000
Southampton Corporation	23,170
Kingston-on-Thames Bridge (tramway expenditure) ...	4,892
City of London (Various Powers) adaptation of tramway at Deptford Market for steam or electrical working	2,000
Kingston-upon-Hull Corporation— Permanent way, £41,000; electrical equipment, £10,500; 30 cars, £22,500; buildings, £21,000; generating plant and machinery, £18,000; land, £1,000	114,000
South Lancashire Tramways— Tramway Construction, £19,600; street works, £2,427 12s.	22,028
Newcastle-on-Tyne Corporation— Tramways, £74,451; works other than tramways, £18,000	92,451
Belfast Corporation	83,570
London County Council— Tramways and street widenings	973,960
Aberdare Urban District Council	17,406
Metropolitan Electric Tramways	35,417
Northampton Corporation— Tramways and street works	139,403
Halifax Corporation— Permanent way, £79,853 4s.; rolling stock, £6,600; electrical equipment, £13,795; electrical equipment for trolley vehicles, £1,400; trolley vehicles, £2,250	103,894
Nottinghamshire and Derbyshire Tramways	15,000
Brighton, Hove and District Railless Traction— Street works	10 569
Manchester Corporation	7,850
Paignton Urban District Council	27,500
Chiswick Urban District Council—Trolley vehicles, £5,000; electrical equipment for trolley vehicles, £6,000	11,000
Rotherham Corporation—Tramways and equipment ...	51,585

RAILWAYS.

London Electric Railway	£407,000
Central London Railway	145,896
Metropolitan Railway	84,808
Metropolitan District Railway	63,100

RAILLESS TRACTION COMPANIES.

The capital powers of the proposed new railless traction companies are:—

Western Valleys (Monmouthshire)...	£60,000
Rotherham, Maltby and District	60,000
Oldham and Saddleworth District	50,000
Malvern	24,000
Matlock District	15,000
Macclesfield and District	100,000
Croydon and Southern District	60,000

Copper.—For the termination of the year Messrs. Merton's circular shows a further decrease in visible supplies of 2,453 tons, the European supplies now standing at 83,797 tons. Stocks in English ports have been reduced by 410 tons, and the stock of fine copper in Havre by 343 tons. Afloat from Chile the quantities are less by 650 tons, and from Australia by 1,050 tons. Estimates of the quantities at Rotterdam and Hamburg are given, amounting to 21,800 tons, but these are not included in the total visible supplies. Supplies from North America are considerably above the average for the year, from Spain and Portugal about 30 per cent. low, Chile shipments above the average, and Australian slightly below it. The total deliveries are still fairly heavy, though not so large as for September, October or November. They total for December 41,127 tons. American visible supplies for November were 58,210 tons, a decrease on the preceding month of 3,960 tons.

The Eight-Hour Law in America.—The turbo-electric machinery for the new battleship to be built at the Brooklyn Navy Yards has been bid upon by only one company, the General Electric Co., owing to the fact that all competitors were deterred by the application of the eight-hour law. This clause occurred in an Act of Congress declaring it to be a penal offence to use labour in excess of eight hours per day by any contractor on any public works of the United States.

A recent opinion has been handed down by the Attorney-General, which states that this law should be construed to apply simply to work done upon the vessel itself at the place where it is built, and not to the manufacture elsewhere of machinery or material that is to enter into its construction.—American *Electrical Review.*

NETWORK PLANS AND DIAGRAMS.

BY CHAS. W. RYCROFT, Chief Assistant Engineer, Swindon.

AFTER many years' mains department experience in important central electrical stations, I have come to the conclusion that while, with the advent of the metallic-filament lamp, our engineers are striving to reduce the cost of services, &c., far too little attention is given to one very important branch of the distribution department, viz., the recording on network plans of details of cables laid.

In the first year or two of the working of a central station, the mains super., who has most likely seen every inch of cable laid in the district, is not disposed to rely on the mains plans for his knowledge of the network, his memory, no doubt, sufficing; but his less fortunate successor, with a 50-ampere leakage to earth to localise and repair, is not so happy, and often has a very heavy task to face, which would be considerably lightened if a reliable map of the network were available to show him just where that cable may be made dead, or give him the correct size and type of this one. Unhappily, while every central station no doubt "boasts" a set of mains plans, few of these can be relied on absolutely, and unless quite reliable they are of very little use.

It is, as pointed out above, the first year or two that is very often the seat of all this trouble. Later on, when faults begin to develop, and the new engineer feels the need of his plans, he begins to amplify them and keep them up to date, only to realise that, like the unfortunate person who built a house on sand, the value of his industry is discounted by the incomplete and possibly incorrect data he started with.

It is essential for the efficient working of a distribution department that it should possess a set of network plans and contingent records on which absolute reliance can be placed, and which should combine neatness and legibility with correct and full information.

I have endeavoured in writing this little article to put forward what my experience has taught me to be a successful system of network plans and diagrams.

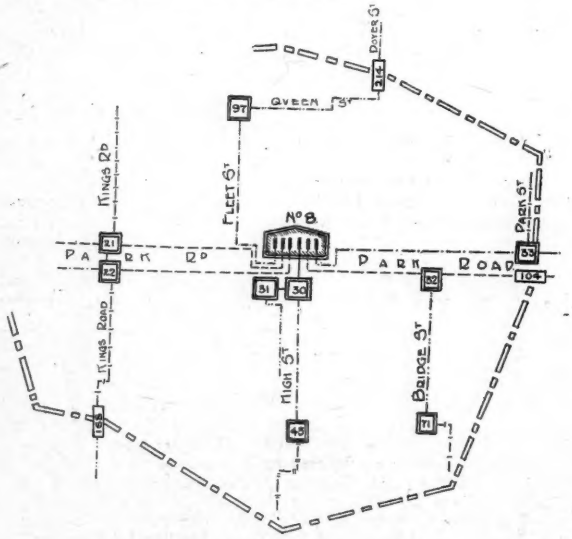


FIG. 1.

I find it necessary to have :—

1. A skeleton plan of the distributing mains.

2. A book containing a diagram of each pillar and street box.

3. A complete set of ordnance survey plans giving detailed information.

4. A specially ruled and printed book for details of services.

I will describe each of these in detail :—

1. The skeleton plan, which I call the "network diagram," should be set out, approximately to scale, so as to embrace the whole area of supply and cover a sheet at most no larger than "double elephant" (40 in. × 27 in.). This size I find very convenient, in that prints may be taken, mounted and folded for pocket use. On this plan, not the streets, but the cables and boxes only are shown. My meaning will be readily grasped on reference to fig. 1.

It will be seen that different kinds of line are used, and these are for the purpose of identifying the different sizes of distributor. Thus, I may suggest,

— — — — — — to represent ·2 × ·1 × ·2 cable
— · — · — · — „ „ ·15 × ·08 × ·15 cable
— | — | — | — „ „ ·1 × ·6 × ·1 cable
— ·· — ·· — ·· — „ „ ·06 × ·03 × ·06 cable, &c.

The thick chain lines, thus ▭ ▭ ▭ ▭ ⊏, which may be further emphasised by putting in red ink, divide the area into districts, each of which is supplied by its own feeder, and where these lines cut through disconnecting or fuse-boxes the points thus marked show at a glance where any district may be isolated, a very useful attribute in case of fault.

Conventional symbols may also be used to show the different types of street boxes, &c. Thus :—

5-way pillar.

Disconnecting box.

Disconnecting fuse box.

Middle-wire feeding point.

Where one of the above is used at a feeding point, it may be coloured to give it prominence.

I do not advocate showing simple straight-through joints on this diagram, preferring to give the exact position of such on the large-scale ordnance plans.

2. The book of sketches of street boxes, &c., is preferably a section-lined, well-bound pocket-book, having its pages numbered consecutively. All the pillars and boxes in the network should also be numbered consecutively for purposes of identification, and by allowing one sketch per page, the two sets of numbers may be made to correspond, thus forming an index for the book.

Figs. 2 and 3 show respectively such diagrams for a feeder pillar and a four-way disconnecting box.

On every cable-way in each pillar or box is shown the nearest point where that cable may be disconnected, so that with a minimum of trouble and risk any main may be made dead or any box isolated.

The diagrams show clearly the exact position in the box of the set of links or fuses connecting any street, and the capacity of fuses where these are inserted—another very useful point.

3. The mains plans proper are drawn on Ordnance Survey plans, the most convenient scale being $\frac{1}{2500}$, or 10·56 ft. to the mile. A complete set of maps to this scale, covering the whole area of supply, is required, and owing to the continual handling of them, it will be found cheaper and better to have cloth-mounted plans.

Each main is shown by a separate line, and to discriminate between feeders, distributors, pilots, &c., conventional colours should be used. These may be—

Feeders ...	... Red	Pilots ...	... Yellow
Distributors	... Blue	Middle wires	... Green.

Full details should be given of the position of cables, *i.e.*, depth and distance from building line, and wherever two or more cables are laid side by side, a section of the cable track should be shown, giving the position of the cables relative to one another. This section of the track should be repeated where this relative position changes. Fig. 4 gives a small portion of a typical plan, which will make the above remarks clear.

Similar conventional symbols on these plans show, as in the network diagram, disconnecting boxes, &c.

Thus—

Disconnecting box.

Service box.

Straight-through joint.

The position of all joints and services must be defined by dimensions from some *fixed* landmark, shown on the

Ordnance Survey map, and the plan of each building into which a service is laid should be given a *light wash* of colour. It will be found convenient in the case of a three-wire system to mark the polarity of the service by the tint used. Thus, a *red* wash may show a service from the positive side, with *blue* for negative, and a *half red, half blue* wash for a three-wire service. A note should also be made on the plan of the building of (*a*) the consumer's number, (*b*) the size of the service, and (*c*) the page number in the book described under the next heading.

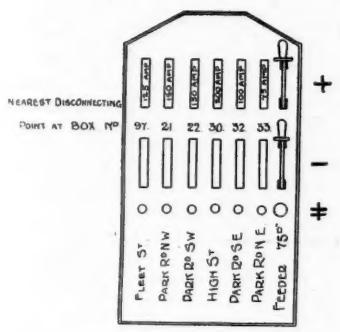


FIG. 2.

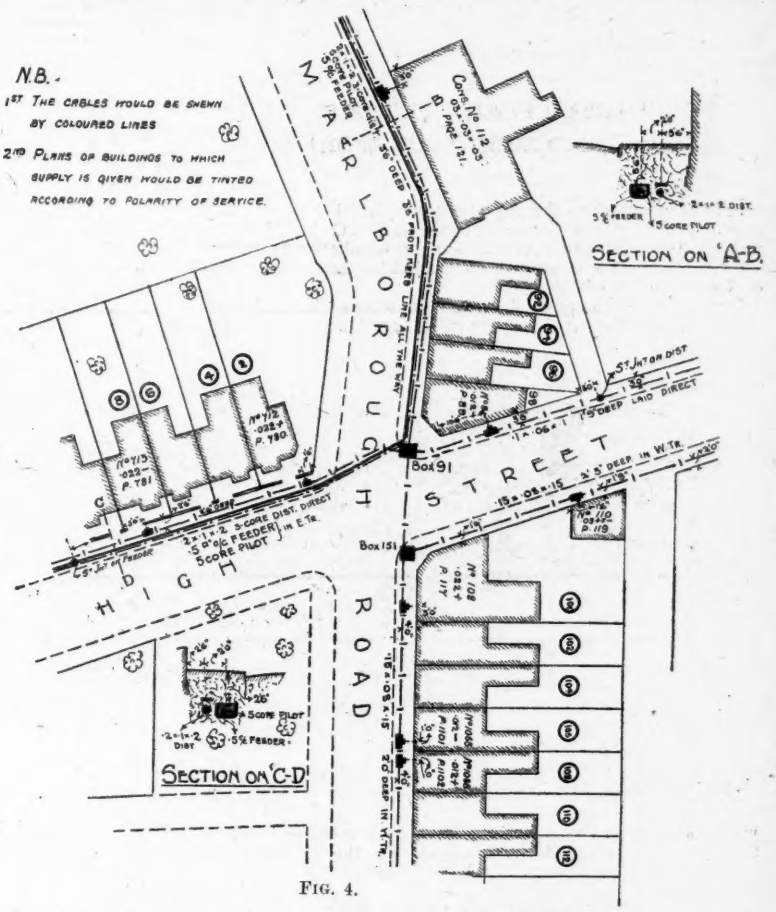

N.B.
1ST THE CABLES WOULD BE SHEWN BY COLOURED LINES
2ND PLANS OF BUILDINGS TO WHICH SUPPLY IS GIVEN WOULD BE TINTED ACCORDING TO POLARITY OF SERVICE.
MARLBOROUGH STREET
HIGH ROAD
Box 91
Box 151
SECTION ON 'A-B.
SECTION ON 'C-D'

FIG. 4.

4. In a specially-ruled and printed book, a specimen double-page of which I give in fig. 5, full details of all services laid, with dates, are entered. Each service requires a full double page, the one side "A" being ruled and printed as shown for the necessary written information. The other side "B" is of section-lined paper for the reception of neat hand sketches of (1) full details of position of service cable, and (2) details of position of meters, cut-outs, and consumers' main switches and fuses.

The latter sketch is especially useful in the case of, say, a three-wire service, with both power and lighting circuits.

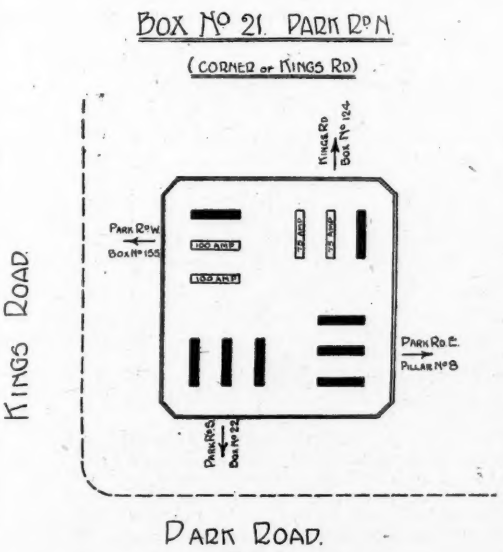

BOX Nº 21. PARK RD N.
(CORNER OF KINGS RD)
KINGS ROAD
KINGS RD Box Nº 124
PARK RD W Box Nº 155
100 AMP
PARK RD E. PILLAR Nº 8
PARK RD Box Nº 22
PARK ROAD.

FIG. 3.

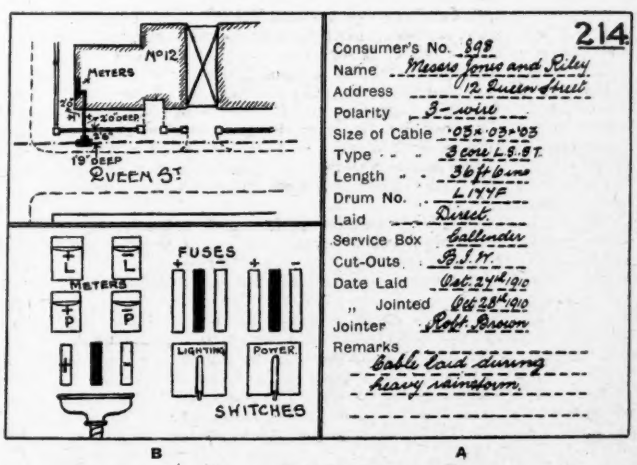


FIG. 5.

When trouble occurs on some part of the installation, and a man from the central station is sent to repair it.

In conclusion, I would impress upon anyone interested, the necessity of *daily* entering up any details of work done. If this advice is followed, much worry and trouble will be saved, I have no doubt.

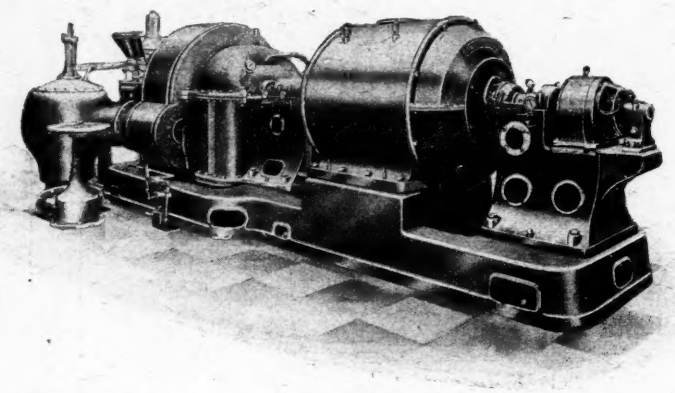
I hope in a subsequent article to deal with the clerical

records in connection with mains work, and in the meantime, I hope that some readers of the REVIEW will have found the above notes interesting, and, may I venture to say, useful.

EXHAUST STEAM PLANT AT THE STAFFORD COAL AND IRON CO.'S WORKS.

AN extensive and interesting exhaust steam plant has now been in commercial operation at the works of the Stafford Coal and Iron Co., Stoke-on-Trent, since June, 1908, and as this installation has proved so satisfactory, a few remarks on the subject of the technical part of the installation will be of interest.

In addition to two groups of coal and iron-stone mines, this company have at work four blast furnaces, a by-product and chemical works, and also a brick works. A supply of waste gas is therefore available, which is used chiefly for the production of steam for driving a large number of engines scattered about the works.



WILLANS EXHAUST STEAM TURBINE AT THE STAFFORD COAL AND IRON CO.'S WORKS.

Of these engines, at present only three of the vertical blowing engines are supplying steam for the driving of exhaust turbines, although it is intended in the future to economise the exhaust from several other engines driving the haulages, fans, &c.

The blowing engines have always exhausted to atmosphere, and the addition of the low-pressure turbines has therefore been carried out without any alteration to the engines themselves. The steam from these blowing engines is led to several large reservoirs, consisting of old Lancashire boilers, where it is thoroughly dried and slightly superheated by means of waste gas. The steam is then in excellent condition for giving good results in the exhaust turbines, which it enters at an absolute pressure varying between 15 and 20 lb.

The power house contains three turbines all driven by exhaust steam; the largest is capable of giving a normal output of 500 KW. when running at a speed of 3,000 R.P.M., and was designed and built by Messrs. Willans & Robinson, Ltd., of Rugby.

Although this firm have recently made considerable advances in the direction of building impulse turbines, it is of interest to note that for plain exhaust steam work they still find the reaction type of turbine, with blades mounted on a short drum of large diameter, to give results both in running and efficiency, which compare favourably with the best results obtainable with turbines of the plain impulse type.

The small clearances at present in turbines of the reaction type when dealing with high-pressure steam are absent in the plain exhaust turbine, consequently the blade stripping troubles associated with high-pressure steam are avoided in turbines of the plain exhaust type.

The bearings are of the standard white metal type, lubricated under pressure by means of a rotary pump driven off an extension of the governor spindle. A hand pump is also provided for use in emergency, or for flooding the bearings when first starting up.

A powerful centrifugal governor (as shown in the illustration above) controls the main throttle valve, which will be seen to be of abnormal size due to the large volume of steam to be dealt with.

In addition to this main governor, an auxiliary "runaway" governor is provided, which actuates a butterfly valve, completely shutting off the supply of steam should the speed exceed a predetermined maximum.

The turbine is direct coupled to an alternator built by Messrs. Bruce Peebles & Co., of Edinburgh; this machine is of the revolving field type with a stationary armature suitable for a 3,300-volt, three-phase supply at a periodicity of 50 cycles per second, and a full load output of 500 KW. at a power factor of ·8. As the speed is 3,000 R.P.M., the rotor is of the two-pole type and excited from a small continuous-current exciter direct coupled to the shaft. The stator coil is built up of laminations of the finest charcoal iron, with numerous spaces providing ample radiating surface and for ventilation. The machine is of the completely enclosed type, with fans fitted to the rotor at both ends, and the end shield is so designed as to allow the air to be sucked into the machine at the slip-ring end as well as the turbine end. After passing through the rotor it passes through the ventilating spaces left in the stator, and finally escapes at the top of the stator, where a special large opening is left. This type of ventilation has been found to be most satisfactory, and has been adopted by nearly all manufacturers of turbo-alternators.

The stator winding is embedded in tubes of pure mica, which line the slots.

In order to obtain the best possible wave characteristics, the slots are nearly closed, and the winding threaded through. Although this is a more laborious job, the results achieved justify the extra expenditure of time thus spent.

The end windings are held by strong clamps to the core, so as to prevent damage being done in case of heavy short circuits. The rotor is built up of numerous laminations of charcoal iron, and the windings are embedded in tunnels, large phosphor-bronze bells being fitted over the end connections at both ends, and spigotted to the rotor core. It may be said that these end bells are a tight fit over the winding, and thus prevent any displacement through centrifugal stresses.

The collector rings are shrunk on to a cast-iron boss insulated with the best mica, and are of steel.

The tests taken on the combined set were most satisfactory, and, as the machine could not be tested on full load at power factor ·8, it was run for six hours at 25 per cent. overload, power factor unity.

The maximum temperature rise obtained on the stator core and rotor winding after this test was 41° F. above the surrounding air temperature.

The voltage regulation was found to be excellent; the total rise in pressure with 25 per cent. overload switched off being about 300 volts, at a slight increase of speed and in excitation. The excitation watts consumed on 25 per cent. overload were approximately 4·5 KW., which is about 0·7 per cent. of the output of the machine at 25 per cent. overload.

In the same power station there are two 300-KW. exhaust steam turbines, manufactured by Messrs. Parsons & Co. One of these drives a three-phase alternator, and the other a blower supplying the blast for the furnaces. The blower has a capacity of 40,000 cb. ft. of air per minute when running at its maximum speed of 3,250 R.P.M.

All three turbines exhaust into a common pipe, to which are connected two surface condensing plants. This arrangement was adopted, in spite of its complication of valves, to allow two of the above sets when working at less than full load to exhaust into one condensing plant. It has been found to give satisfactory results in the present instance, owing to there being both compressed air and electricity supplied for power purposes. A simpler arrangement would have been to have had only electrical generators in the power station, while small electrically-driven compressors supplied the blast as required to the furnaces.

A New Electrical Society.—"The Generators," a society to promote good fellowship and social intercourse among electrical engineers, held its 1911 gathering on Friday, January 6th, at Frascati's, where covers were laid for 66 members and guests, 66 being the maximum number of members, and also the maximum number at any gathering. Mr. Haydn T. Harrison presided, and according to the unwritten rules, there were no speeches and only one toast besides that of the King, namely, "Chief Generator Harrison." An excellent programme of music was provided, and with the exuberantly cheerful secretary, Mr. J. T. Corneille, running the programme and between whiles flitting hither and thither among the members and guests, harmony reigned. One of the rules provides for the scrapping of any "generator" who does not come up to specification, but judging from the samples submitted, this rule might be struck out.

Electrician's Accident.—An Edinburgh electrical engineer named Reynold Munro, met with a serious accident last week, while at work at Delvine House, Perth, where electric light is being installed. He was making use of a paraffin lamp which exploded, with the result that he was badly burned about the head and upper part of the body. A fellow worker who went to his assistance, also sustained painful injuries.

Renfrewshire Royal Engineers.—After undergoing a spell of eight days' winter training, the Electric Light Company of the Renfrewshire Fortress Royal Engineers have left Fort Matilda, Greenock, after inspection by General Friend, Commander of the Clyde Coast Defences.

An Appeal.—An appeal has been entered against a judgment obtained by a person for injuries alleged to have been sustained as a result of an explosion in the electric feeder pillar at the junction of Latchmere Road and Battersea Park Road, on October 29th, 1909, and in which a verdict was given for the plaintiff for £525 and costs.

IRONCLAD SWITCHGEAR FOR USE IN MINES.

THE extensive use of the three-phase alternating-current system for supplying apparatus installed in mines has caused special attention to be directed to the provision of suitable totally-enclosed oil switchgear for use on systems up to 3,500 volts.

Hitherto, it has been customary to supply ordinary switchboard type apparatus enclosed in sheet-iron cubicles. It has been found

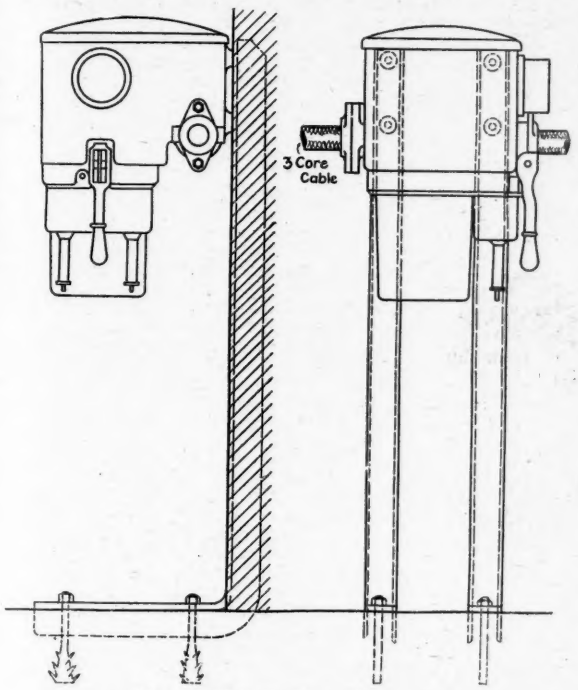


FIG. 1.—B.T.-H. WALL SWITCH.

in practice that this arrangement leaves much to be desired, on account of the unsuitability of the apparatus, and of the large size of the cubicles and their liability to damage and decay under the rough conditions and poor atmosphere met with in many mines.

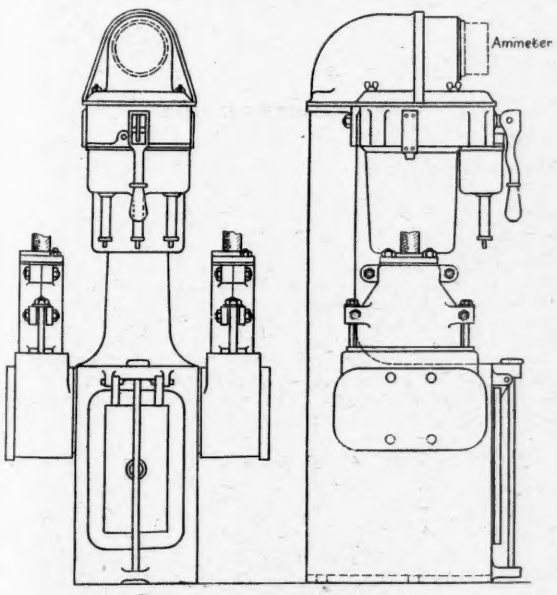


FIG. 2.—B.T.-H. PEDESTAL SWITCH

The B.T.-H. Co. have, therefore, abandoned the use of ordinary switchboard apparatus, and have developed special mining switches, as shown in the accompanying illustrations.

These switches have been specially laid out with a view to combining every element of satisfactory operation with low price, and to meeting the most severe requirements of service on systems of 3,500 volts, or less. They have been designed with the object of providing a totally-enclosed oil switch, which can be fitted with any of the usual automatic attachments, instruments, &c., and which can be operated with perfect safety by unskilled workmen.

The switches are suitable for bolting to a wall, or they can be supplied with pedestals containing cable boxes, isolating switches, starting rheostats, bus-bars, &c., all the pedestals being arranged so that, when required, a number of them can be bolted together and

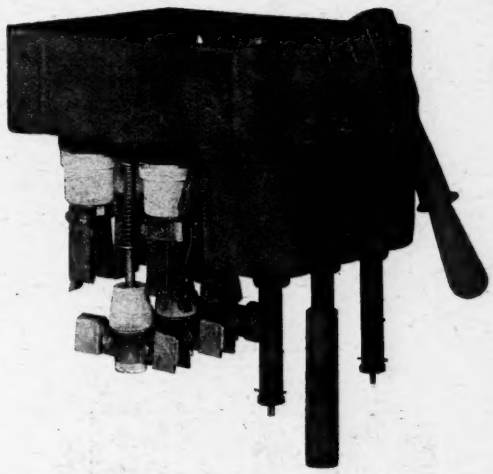


FIG. 3.—OIL SWITCH, WITH 2-COIL SERIES TRIP AND LOW-VOLTAGE DEVICE, FOR 300 AMPERES AT 3,000 VOLTS: COVER AND CAN REMOVED.

provided with continuous bus-bars to form a complete ironclad switchboard.

The compactness of the design and the mechanical construction of these switches are clearly shown in the accompanying illustrations. The whole of the live parts of the switch are supported on porcelain insulators, thus obviating the use of wooden rods, and the operating mechanism is constructed of malleable and wrought-iron with hardened steel rollers and catches. The contacts and all current-carrying parts of the switches are constructed of wrought copper, and the contact fingers and blades are readily renewable. The switches are opened or closed by a single motion of the

FIG. 4.—SWITCH WITH AMMETER AND VOLTMETER, MOUNTED ON PEDESTAL.

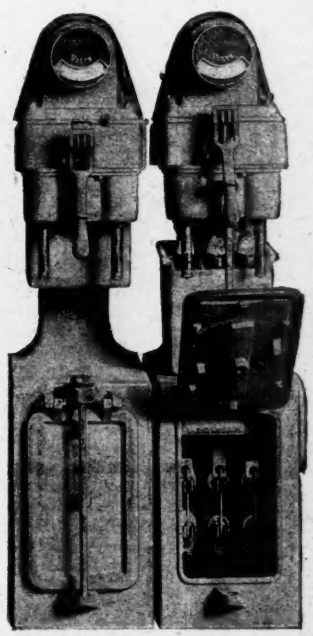


FIG. 5.—SWITCHES WITH VOLTMETERS MOUNTED ON PEDESTALS WITH BUS-BAR COMPARTMENTS, SHOWING ISOLATING SWITCHES.

operating lever, which is arranged so that both a quick make and quick break are obtained. The switch is opened by gravity when the catches which hold it are released, and the motion of the switch is accelerated by the aid of springs.

The tripping mechanism is of the free-handle type, arranged so that the switch cannot be held closed on a fault. The action when opening is quick and positive, and a double break of ample length is obtained.

Typical switches and attachments are shown in the accompanying illustrations, and the line drawings show two examples of these switches specially arranged for use in mines, where it is particularly desirable that the armouring of the cable should be solidly connected together throughout the whole system.

The wall type switch shown in fig. 1 is arranged so that the main armoured cables enter the casing through glands close to the wall. An armour clamp of substantial design is provided at the point where the cables enter, and the construction of the casing is such that a pocket is formed which can be filled with compound if it is desired to seal the end of the cable. Access to the operating mechanism, and to the connections, &c., is readily obtained by removing the top cover, which is a plain dome casting fixed with a stout screw-down bolt and padlock.

The whole device is provided with packed joints, so as to render it dust-proof and water-proof, and the shape of the top is such that any drippings which may fall upon it run off without going near

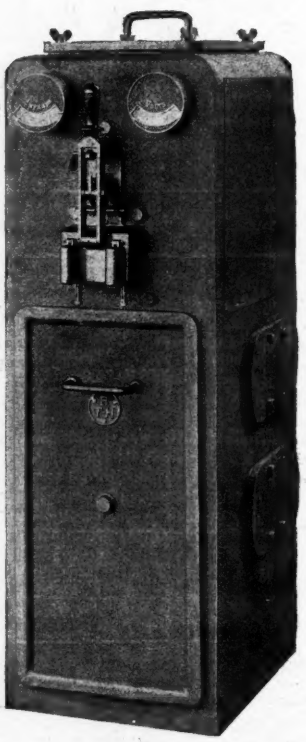


FIG. 6.—PEDESTAL-TYPE IRONCLAD SWITCHGEAR.

the joints. The overall dimensions of the complete devices are quite small, in spite of the fact that the switch proper is unusually large and of superior mechanical construction.

The pedestal type switch shown in fig. 2 is arranged with reversible cable receiving boxes mounted at each side of it, so that the cables can enter either from above or below.

The cable boxes are provided with substantial armour clamps, and are bolted solidly to the main pedestal casting. Space is provided in the bottom of the pedestal in which the isolating switches can be mounted as required, and access to these switches is given by a hinged door interlocked with the main oil switch, so that this door cannot be opened unless the oil switch has first been opened, and so that when this door is open the oil switch cannot be closed.

Either the wall type or pedestal type device can be used for making a tee-off or straight-through connection, and in the case of the pedestal type, isolating switches can be provided.

In addition to the two examples particularly described above, the B.T.-H. Co. have developed a large number of special combinations to meet varying conditions. Some of these are shown in figs. 3 to 6. Throughout, the endeavour has been to provide a cast-iron structure containing apparatus of simple and mechanical design, the whole arrangement being such that it can be installed in a minimum of space, and operated without injury by the ordinary rough labour employed in and about mines.

Fatality.—At an inquest held at Swansea last week, into the cause of death of John C. Davies, who was killed by a shot-firing accident by electricity at the New Henllys Colliery, Brynamman, the jury returned a verdict of "Accidental death," but added a rider that men who had anything to do with electric batteries underground should be examined to see that they were capable men who understood something about batteries and electricity.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Queries in Connection with Heat.

With reference to my letter which appeared in your issue of December 16th, 1910, and your editorial reply thereto, with which reply I am substantially in agreement, there are one or two further questions that I would like to raise.

Taking it for granted that the final steady temperatures of the light and heavy cubes will be the same when both surfaces are the same, *e.g.*, lampblacked; what will be the difference between the final steady temperatures if one cube be highly polished, and the other cube be lampblacked? Obviously, the polished cube will ultimately arrive at a higher temperature than the other, but how much higher? Is there any approximate rule to guide one to a conclusion, or have such rules still to be formulated?

Then, again, take two cubes of exactly the same dimensions and the same radiating capacity, and each supplied with energy at the same rate; if one cube is made of iron, and the other cube is made of aluminium, what will be the effect? Bearing in mind the fact that the specific heat of aluminium is much higher than that of iron, which cube will first reach the final steady temperature, and to what will the difference in time be proportional?

The latter problem is one to which I can find no direct solution in the text-books.

C. Orme Bastian.

London, E.C., *January 9th*, 1911.

Cathode Ray Telephotography.

Referring to the paragraph under the above heading in your issue for to-day, in which two German inventors, Messrs. Dieckmann and Glage, are credited with the suggested use of cathode rays as a means for avoiding the difficulties due to inertia in electro-telephotography, may I refer you to my letter published in *Nature* for June 18th, 1908, in which you will see, from the enclosed copy which you may care to reproduce, I made a similar suggestion.

A. A. Campbell Swinton.

London, S.W., *January 6th*, 1911.

Extract from *Nature*, June 18th, 1908.

DISTANT ELECTRIC VISION.

Referring to Mr. Shelford Bidwell's illuminating communication on this subject, published in *Nature* of June 4th, may I point out that, though, as stated by Mr. Bidwell, it is wildly impracticable to effect even 160,000 synchronised operations per second by ordinary mechanical means, this part of the problem of obtaining distant electric vision can probably be solved by the employment of two beams of cathode rays (one at the transmitting and one at the receiving station) synchronously deflected by the varying fields of two electromagnets placed at right-angles to one another and energised by two alternating electric currents of widely different frequencies, so that the moving extremities of the two beams are caused to sweep synchronously over the whole of the required surfaces within the one-tenth of a second necessary to take advantage of visual persistence.

Indeed, as far as the receiving apparatus is concerned, the moving cathode beam has only to be arranged to impinge on a sufficiently sensitive fluorescent screen, and given suitable variations in its intensity, to obtain the desired result.

The real difficulties lie in devising an efficient transmitter, which, under the influence of light and shade, shall sufficiently vary the transmitted electric current so as to produce the necessary alterations in the intensity of the cathode beam of the receiver, and further in making this transmitter sufficiently rapid in its action to respond to the 160,000 variations per second that are necessary as a minimum.

Possibly no photoelectric phenomenon at present known will provide what is required in this respect, but should something suitable be discovered, distant electric vision will, I think, come within the region of possibility.

A. A. CAMPBELL SWINTON.

66, Victoria Street, London, S.W., *June 12th*.

Turning Down Incandescent Lamps.

In your last issue you publish a letter from Mr. George Wilkinson, in which the following sentence occurs:—"The advertisement includes a Faraday House certificate of a test on one of the switches, but this certificate *carefully avoids* all

reference to the very heavy current consumption taken by the resistance."

We do not for a moment wish to suggest that Mr. Wilkinson questions the impartiality of the report issued by Faraday House, but we regard the above sentence as being unfortunately worded.

We were not instructed to report on the switch as a current-saving device, but were specifically asked to make tests of its regulating power and insulation. To have included "candles per watt" in our certificate would have been to volunteer to give our clients experimental data for which they had not asked, a course which is obviously inconsistent with professional etiquette.

In case any misapprehension may have arisen in the minds of those who are not familiar with the character of the reports issued by this Institution for the last 20 years, we should be obliged if you would publish this letter.

Ernest A. Nash,

Secretary and Business Manager, The Electrical Standardising, Testing and Training Institution.

London, W.C., *January 9th*, 1911.

The Pay of Station Engineers.

I trust you will excuse me again referring to this hackneyed subject, but I submit that one or two recent advertisements should receive some comment.

For instance, we find that a chief assistant engineer is required, at a salary of £1 per week plus glory (the latter is not definitely stated, but only insinuated, as a "gentleman" is required); and, further, we find an advertisement calling for a first shift engineer (who must also be a fitter) at 35s. per week, second engineer at 30s. per week, third engineer at 27s., whilst in the same breath the advertisement calls for a jointer at 38s. per week.

Now, in commenting on the above advertisements, it will generally be agreed that all shift engineers should be fully qualified men who have had previous training, exactly as in the case of the jointer; therefore, in comparing the salaries one immediately comes to the conclusion either that the shift engineer need not know anything of engineering, or that the jointer must be overpaid. We know that the jointer is not overpaid, therefore the advertiser must really require improvers or engine drivers, and not trained, qualified men. I think it is about time that the title of "shift engineer" should be treated with some respect, instead of dragging it in the mud as station engineers are now doing.

These advertisements appearing week after week in the technical Press have already caused the shift engineers to be despised by laymen and also by their subordinates. Of course, shift engineers are themselves to blame to a certain degree for allowing the State of Denmark to become so rotten, but I now think it is time they were paid according to their responsibility, and that trained men and not improvers were employed for responsible posts. The manufacturing engineers are now receiving the benefits of improved trade, so why should not the shift engineers?

Whether the low salaries of shift engineers have anything to do with the appalling ignorance shown by station engineers I am unable to say, but it is very strange that this complaint of ignorance in high quarters, both from station staff and from manufacturers, is so general. Stranger still, the majority of station engineers are members or associate members of the Institution.

There are several of these gentlemen who are too penny-wise to realise the false economy of reducing salaries in such vital sections of their organisations. Personally, I think the man who cannot produce *satisfactory* running costs without starvation wages ought to be relieved of his post, whether he be a municipal or a company official. Socially he should be despised as a sweater on a level with the Teutonic Hebrew of the East End.

Two solutions suggest themselves: the first, that of getting the Institution to set a standard (as per the wiring rules); the second, which is the natural alternative to the first, that of a trade union. We have already received answers to both of these, viz., the Institution is not to be used as a trading concern, and the shift engineers are too proud to form a union.

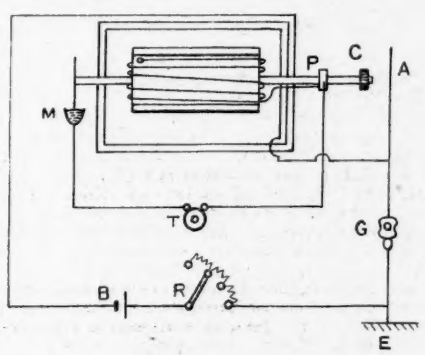
I have already taken up too much of your valuable space (should you print this), so in concluding I will only mention that already I seem to hear the successful jointer, in the case cited above, confidentially informing the stoker (there will be no engine driver, it seems) with a sneer, of the respective salaries of the shift engineers, and suggesting that should the fitters' Union have something to say about it they would only be doing their duty.

Pataud.

WIRELESS TELEGRAPHY.

By H. A. HALL.

We are aware that carborundum, galena and some other crystals have the property of converting high-frequency alternations (such as are used in wireless telegraphy) into a succession of unidirectional impulses, the rectifier making these changes or alterations in the state of things perceptible in a telephone receiver, connected either directly or indirectly with the receiving antenna. I would propose to use an intensifier constructed similarly to a magneto, but, of course, dispensing with the field magnets, and in their stead having many turns of wire wound to a high resistance and a finely laminated core in the armature, the poles of which are connected to the make and break M and rubbing contact P respectively. The idea of the make and break in this intensifier is to make contact when the armature is in the strongest



part of the field; otherwise we should expect to receive an approximately uninterrupted sine curve. The make and break consists of an iron trough filled with mercury, into which dips a steel needle. In an experimental apparatus it was found that at each make and break a distinct click was heard in the telephone receiver T, due undoubtedly to the contact of different metals. Barring this one small flaw, the receiver gave great satisfaction. The intensifier is placed in an iron box so as not to be directly susceptible to outside influences, such as the earth's magnetic induction. The armature is rotated at high speed by clockwork through the pinion C; A is the antenna, G the rectifier, B a battery, and R a variable resistance.

"Metalik" Lamps.—We are informed that at the Grand Theatre, Mansfield, two of MESSRS. G. M. BODDY & CO.'s 50-C.P. "Metalik" lamps have been in constant use for over three years, and have burned between 8,000 and 9,000 hours, though they have frequently been taken down and cleaned. This record speaks well for the strength of the filaments. "Vibration-proof metaliks," suitable for factories and other places where there is much vibration, have recently been introduced, as well as candle lamps, but the long-lived lamps mentioned above were of the ordinary "Metalik" type.

A Swedish Locomotive Contract.—It is reported from Berlin that the SIEMENS-SCHUCKERT WORKS CO. has commissioned a Swedish firm at Falun with the construction of 24 electric goods train locomotives, which are to be delivered by the Berlin firm for the working of the Lapland railway by the month of June in 1914. The price of the locomotives to be built by the Swedish firm amounts to about £1,250 per engine. If this report is correct it would seem to suggest that under the contracts for the electrical equipment of the railway the constructional work has to carried out as far as possible in Sweden.

THE PHYSICAL SOCIETY'S EXHIBITION.

(*Continued from page 9.*)

ROBT. W. PAUL.

An exceptionally interesting series of novelties was shown by Mr. Paul, some of which are illustrated below.

Fig. 17 shows the Drysdale standard resistance coil of bare wire wound on porcelain pillars. These coils, which are made for 1, 10 or 100 ohms, are compensated for temperature by the method described by Dr. Drysdale (B.A. Report, 1907). The wire is of a special alloy, plated with nickel, and the temperature coefficient is

FIG. 17.—DRYSDALE STANDARD RESISTANCE.

only one or two millionths per degree Centigrade. The terminals are specially designed for mercury contacts or current connections, and potential terminals are also fitted. The coil may be sealed into its case with or without oil, and is capable of carrying considerable current without deterioration.

The oil-cooled decade resistance box (fig. 18) represents the latest development in the construction of precision resistances, the coils being wound on large split brass tubes, and each set of 10 being mounted on a vertical shaft with ball bearings, which shaft also carries the contact segments. The brushes are stationary, and mounted so as to be self-adjusting to the contact surfaces; pressure is applied by two independent springs to each brush, which consists of a great number of copper leaves, each making direct connection between one dial and the next, thus dispensing with internal wire connections and reducing the contact resistance to about 0·0002 ohm. Each complete dial may be lifted out of the box after removing the adjacent brushes from their bearings; the whole is mounted on a strong aluminium frame, and may be immersed in oil

FIG. 18.—INTERIOR OF OIL-COOLED RESISTANCE BOX.

above the level of the contacts. The insulation throughout is of mica, and a resistance box of 111 ohms is capable of carrying 1 ampere continuously.

Fig. 19 shows the flush type series resistance box. The weak points in the usual plug type of resistance box, in which the blocks frequently work loose under the wedging action of the plugs, have been entirely eliminated in this design. The blocks are embedded in a thick block of insulating material, into which they are also keyed, so as absolutely to prevent movement. Clearances are provided between and under the blocks, so that the plugs do not come into contact with the insulating material, and there are no places for dust to lodge in. The insulating knobs are moulded on to the plugs, and therefore cannot come loose. This construction not only presents the advantage of high insulation and strong mechanical construction, but the accuracy of fit of the plug contacts is more permanent.

In the Unipivot dynamometer for measuring small alternating currents, fig. 20, the fixed coils are of cylindrical form, with a spherical space in which a circular moving-coil swings. This coil is mounted in the same fashion as the well-known Unipivot direct-current instruments. This design has rendered possible the production of a handy portable instrument capable of giving full scale deflection for 0·5 volt or for 0·01 ampere. The divisions of

FIG. 19.—FLUSH TYPE RESISTANCE BOX.

the scale are fairly uniform, except at its extremities. The resistance and inductance have been kept low, the latter being about 6 millihenries, while the movement is fairly dead-beat. The instrument can readily be adapted for any higher reading of current or pressure, and may be used as a wattmeter.

An interesting high-frequency milliammeter consists of a sensitive Unipivot millivoltmeter with a simple and compact thermo-junction, which is easily rewired by an unskilled person, and can be readily attached to the terminals of the millivoltmeter. The thermo-junction itself (fig. 21) consists of a fine steel wire, with which is looped a Eureka wire, tension being applied by two springs to ensure contact at the point of crossing. An alternating or pulsating current applied to the terminals of the thermo-junction causes heating at the centre of the cross wires, and the rise of temperature is measured by the thermo-junction formed by the two

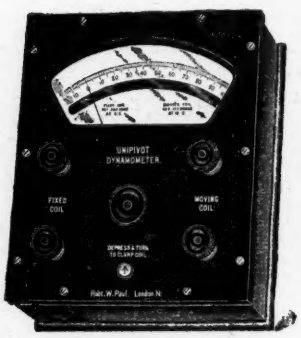


FIG. 20.—UNIPIVOT A.C. DYNAMOMETER.

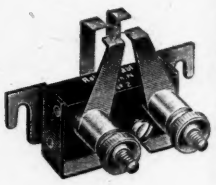


FIG. 21.—THERMO-JUNCTION OF MILLIVOLTMETER.

wires, which are also connected to the millivoltmeter. The pattern exhibited gave a full scale deflection on the millivoltmeter for 100 milliamperes.

Among other new types of instruments shown were thermo-electric and resistance pyrometers, including an indicator with a magnifying device by means of which readings can easily be taken at distances of 20 or 30 ft. A large lens is mounted on a swinging arm, which can be readily brought to the normal position of the pointer on the scale, and at the same time the instrument itself may be swung round so as to face in any desired direction.

The Unipivot universal set for measuring insulations, pressures, currents, resistance, and so forth, as well as a number of patterns of Unipivot instruments, which we have recently described, were also exhibited.

(*To be continued.*)

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Alloy.

A new white metal alloy called "Atherium" has recently been brought out, for which some remarkable properties are claimed. In the first place, it is lighter than aluminium; the specific gravity is 2·4 to 2·57, according to the mixture. Combined with this remarkable lightness the alloy has a tensile strength of 18·66 tons to the sq. in. A test made by Mr. R. H. Harry Stanger, of Westminster, on a test piece 0·628 in. in diameter showed an elastic limit of 33,712 lb. per sq. in. and an ultimate strength of 41,798 lb. per sq. in. The extension of 2 in. measured length was 17·5 per cent., and the reduction of area was 39·1. The alloy has the valuable property of making good sound castings, and works well in rolling and turning. Clean screw threads can be cut, and it can also be soldered, forged and welded. It does not tarnish or corrode, and withstands the action of sea water. It is also electrically positive. The conductivity is about 55·1. The sale of this alloy is in the hands of MESSRS. PRITT, BOWLEY & CO., 46, Fenchurch Street, London, E.C.

New Fittings Showrooms.

MESSRS. FALK, STADELMANN & CO., LTD., have made great alterations in the electrical departments of their extensive premises at 83, 85 and 87, Farringdon Road, London, E.C., since we last paid a visit to their showrooms. Quite a transformation has been wrought by dividing the electrical showrooms off into four separate sections which are now approached direct from a new entrance at Farringdon Road, and the first department as we enter is that overlooking this thoroughfare. It is also the last in which the customer generally makes his selections, being devoted almost exclusively to a fine assortment of glass shades which naturally are chosen after the fittings themselves have been decided upon in the course of the tour of the three other departments. Behind the glassware section is the Crimson Room, then the Green Room, and last of all the French Grey Room, in which there is a great assortment of electrical accessories. In the Crimson Room there is a very varied display of electric fittings, in Sheraton, Adams, Georgian and other styles, including electroliers and brackets, pendants, &c., of tasteful designs, and in the Green Room there is a collection of lighter designs, including dining room, bedroom and other fittings. In the French Grey Room will be found a large collection of lighting and bell accessories, telephones, radiators, medical coils, street lamp fittings. A feature of the glassware room is the arrangement of a large number of incandescent lamps on the "Bro-ite" flexible strip system all round the room. This is one of the lines that the firm has in readiness for the large Coronation electrical illumination business which is pretty sure to come the way of those who are prepared for it. On a lower floor of the same building, Messrs. Falk, Stadelmann have a number of show-cases and stands effectively displaying a number of current lines. Among these we noted a show-case of "Lux" candle fittings, a number of large crystal fittings suitable for hotel illumination, and smaller ones for private residential purposes. Many Georgian and Flemish candelabra made after well-known models, and an interesting collection of standard fittings in bronze and imitation bronze, are also in evidence here. In the arrangement of the entire premises care has been exercised to display each piece to the best advantage under conditions approximating to the position for which it has been designed. In the accompanying photograph we give a view of one of the rooms with the object of conveying a general idea of the style and manner of arrangement which have been adopted, but it is, of course, impossible to write here of all the impressions that were made upon our mind as we wandered from room to room. The firm invites the trade, also consulting engineers, architects, contractors and ironmongers to inspect the premises and take their clients along with them to choose their requirements.

FIG. 1.—TYPICAL VIEW IN FALK, STADELMANN'S SHOWROOMS.

New Electrical Bed-Warmer.

MESSRS. FRAMPTON & PAINE, of 29, Old Queen Street, S.W., are placing on the market a new electric bed-warmer invented by Dr. Kinzbrunner, which, it is claimed, constitutes an entirely new departure. The heating element is stated to be absolutely reliable, and to have a life of over 1,000 hours, while it can be renewed at a trifling cost, and the initial cost of the apparatus is very low. It is sold with a washable cover, flexible and adapter.

Vibration-proof Metallic Lamp.

MR. S. HORVATH, with a view to overcoming the loss and annoyance due to the breakage of metallic filaments, has invented and patented a new device in connection with the "Mascot" lamps, which are manufactured at his works at Southfields. Instead of looping the filaments over hooks as is generally done, he passes them through little rings, which in turn hang freely in the hooks, and the latter are carried by very thin and flexible arms. It is claimed that the freedom thus given to the filaments prevents their breakage, and when they are incandescent the hooks are protected from heat by the intervening rings, so that they are not liable to soften and release the filaments. The lamps are of very handsome appearance, judging by samples that we have received. They are being put on the market by Messrs. Galsworthy, Ltd., 15 and 16, Newman Street, W.

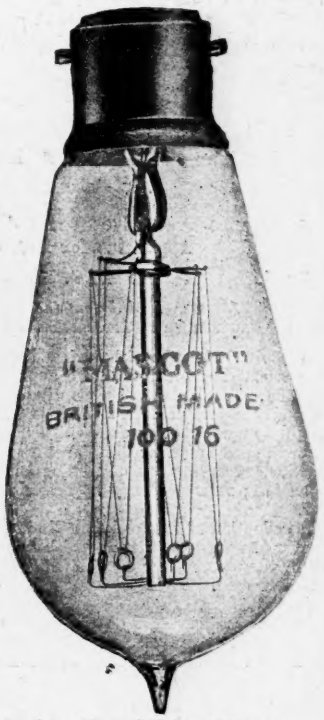


FIG. 2.—NEW "MASCOT" LAMP.

Quartzalite Heaters.

We regret that in the notice of these heaters in our issue of the 6th inst., the power capacity was erroneously stated to be 2 KW. instead of ½ KW.

"Isogrip" Workshop Flex.

MESSRS. WARD & GOLDSTONE, of Springfield Lane, Salford, have brought out an improved type of workshop flexible, especially suitable for use with their "Isogrip" holders; as the latter have large cord-grips, which grip the two leads separately with an insulator between them, the ordinary workshop flex with both leads under one braiding is not well adapted for use with them; the new "Isogrip" flex as shown in the figure is made with the leads separately braided and compounded, and afterwards twisted together like ordinary flexible. The conductors are insulated with vulcanised or pure rubber as required.

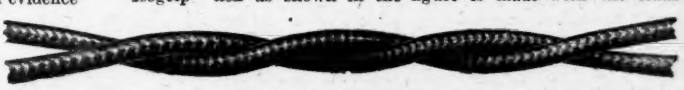


FIG. 3.—"ISOGRIP" FLEX.

New Frequency Meter.

The type of measuring instrument employing two meters with crossed pointers, which has been known for many years in this country, has recently been reinvented in France, and has been adapted to the measurement of frequency. Two hot-wire ammeters are used, connected respectively in series with inductance and non-inductive resistance; the two circuits thus formed are joined in parallel, and placed, in series with a resistance, across the mains in which the frequency is to be measured. It will be obvious that a change of frequency will diminish the current through one, and increase it through the other meter, so that the point of crossing will vary according to the frequency; it varies also with the pressure, and the scale therefore takes the shape of a set of approximately horizontal and vertical but curved lines, over which the two pointers move, both the frequency and the voltage being simultaneously indicated by the crossing-point of the pointers. The device, due to Mr. Ferrié, is made by Mr. J. Carpentier, and with the aid of a simple calculation, is calibrated with direct current.

F

The same principle has been applied to instruments for use in wireless telegraphy; obviously, if the frequency can be measured, the wave-length can also be determined. An instrument of this kind has been introduced, giving wave-lengths direct, from 250 to 1,100 metres, and by cutting out the inductance the same instrument is made to read the current going to the antenna.

The use of the device as an ohmmeter, for which purpose it was originated by Groves in 1904, is also described in our contemporary, *La Lumière Electrique*, and a pattern devised for military use is illustrated, as well as a wattmeter on similar lines.

PROCEEDINGS OF INSTITUTIONS.

Merz-Price Protective Gear and other Discriminative Apparatus for A.C. Circuits.

By K. FAYE-HANSEN and G. HARLOW, Associate Members.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Manchester, December 20th*, 1910.)

THIS paper deals only with devices for protection against excessive currents and not with protective apparatus which deals with over-potential. Discriminative protective devices are those which cut out faulty apparatus only and leave healthy apparatus in circuit absolutely unaffected by faults external to them.

For the protection of distributing systems there are three main methods of carrying out discrimination, viz.:—Overload time-limit protection; reverse energy apparatus; and Merz-Price protective gear.

The adoption of overload time-limit protection is limited by the number of points in series at which the system is to be protected, and by the use of ring mains on which overload time-limit apparatus cannot be used. There are many cases where the overload time-limit protection can be applied very effectively, either with the fixed time-limit system or the inverse time-limit system. The advantage of the inverse time limit is that it will operate quicker the heavier the fault. A combination of fixed and inverse time

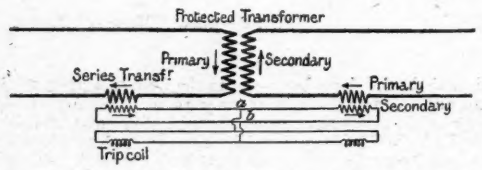


FIG. 1.

limit makes it possible to have more points in series without the time limit nearest the generating station having too long a setting. One objection to all time-limit systems (particularly those with fixed time limits) is that a fault is not immediately cut out, but has time to increase, so that the cables or apparatus may suffer more than if instantaneous protection is adopted.

Reverse energy protection can only be used where power is flowing in one direction alone when the section protected is healthy, and cannot therefore be used in interconnectors, ring mains, &c., where the power may reverse under normal working conditions. Reverse energy protection is mainly used at the incoming (power receiving) end of parallel feeders, or in connection with alternators, motor-generators, &c., working in parallel.

The Merz-Price Protective Gear.—This is based upon the fact that the currents (or the energy) flowing in and out of apparatus or cables are equal (neglecting losses). In case of fault, however, this condition is changed, and the change is utilised for the operation of the switches. This protective gear is therefore inherently a discriminative system, while all the others can only be made so by skilful adaptation.

The protective gear described has the great advantage that only faulty apparatus is cut out of circuit, and this is accomplished instantaneously. It can be used for nearly all conditions, and its general use is mainly limited by the necessity for pilot wires and the cost which these entail. The gear is shown in its simplest form in fig. 1, which illustrates the protection of a single-phase transformer, there being two series transformers, one in the primary and one in the secondary of the protected transformer. These two series transformers are arranged so that their secondary currents are equal, and flow in the same direction round the local circuit formed by their two windings. The whole E.M.F. of this secondary circuit is consumed in overcoming the internal impedance of the two series transformers, since the resistance of the connecting leads between the secondaries can be made negligible. Hence, if trip coils be connected across the secondary circuit, as shown, no current will flow through them, because no potential exists across the two points, *a* and *b*, so long as the currents in the protected transformer flow in a normal direction and have the normal ratio. Should, however, the ratio between primary and secondary currents of the protected transformer be changed, as will happen when a fault occurs in the transformer, the secondary currents of the two series transformers will differ in value or phase, or both, and this vectorial difference will flow through the trip coils and, if large enough, operate them

Instruments, relays, &c., may be connected in the secondary circuits of the series transformers if desired. The trip coils are shown connected in parallel, but can equally well be connected in series.

On the balanced-current system, three pilot wires of the total length of the feeder are required for the protection of a single-pole single-phase feeder.

On account of the extra pilot wires, &c., the balanced-current system has, to the authors' knowledge, never been used in practice in conjunction with feeder protection. For this service a balanced-voltage system, as shown in fig. 2, has been invariably used. This diagram shows the arrangement for a single-phase single-pole system, and in this case the secondaries of the series transformers

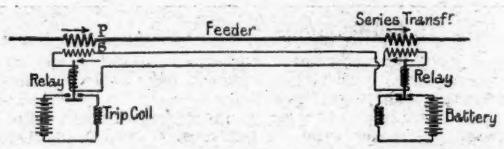


FIG. 2.

are connected in such a manner that they oppose each other when current is flowing through a healthy feeder. The series transformers have to be adjusted so that the secondary voltages induced in both are identical in magnitude and phase at all primary currents. With such transformers no current will flow through the pilot wires or relays so long as the feeder is healthy. If, however, a fault occurs in the feeder between the two series transformers, the current flowing in the primary of these will be different in amount or phase, or both, and hence in the secondaries of the series transformers the electromotive forces will also be different. This difference in E.M.F. will force a current through the pilot wires, relays and secondaries of the series transformers, which current, when large enough, will operate the relays and close the battery circuit through the trip coil.

When used for generators the Merz-Price gear can only protect against a fault to earth or between phases, but does not take care of breakdown between different parts of one phase or loss of field or loss of power, so that we do not recommend its use for generators.

The protection of a three-phase transformer connected star to delta is shown in fig. 3, and here it is necessary to connect the series transformers star to delta in the reverse manner to that in which the main transformers are connected, that is to say, where the main transformer is connected in delta the series transformers are connected in star and *vice versâ*. The fuses shown are necessary to prevent the rush of magnetising current during switching operations (which, of course, flows in the primary side of the transformer only) from passing through the trip coils and tripping the switch. This is necessary for both polyphase and single-phase transformers, though the fuse is not shown in fig. 1. Normally, these fuses carry only a current proportional to the magnetising current of the transformer.

A breakage in the pilot wire circuit prevents the operation of the balanced-voltage system in case of fault, and is difficult to locate without frequent testing of the pilot wires. Such a breakage with the balanced-current system, results in the immediate isolation of the section in which the fault occurs. As the protective gear is generally used in connection with at least a duplicate supply, it is

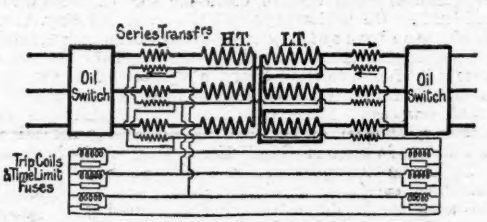


FIG. 3.—γ—Δ TRANSFORMER.

probably advantageous to have an unprotected section immediately disconnected, since one source of supply is still available and all possibility of false security is removed.

A break in the trip coil or trip-coil circuit renders all systems inoperative.

The balancing of transformers must be most carefully carried out on the balanced-voltage system, whilst in the balanced-current system there is no necessity for such accurate balancing. The balanced-voltage system can be used for protection only, whereas the balanced-current system may be used in many cases for measuring purposes in connection with instruments. The balanced-current system requires less power than the balanced voltage system.

The authors believe that the balanced-current system, wherever applicable, has an advantage compared with the balanced-voltage system, if it is possible to adopt it without an increase in cost. This can be done without difficulty in the protection of stationary apparatus where the length of pilot wire is small.

In the case of feeder protection, the auxiliary tripping circuit can be operated either from a D.C. circuit or an A.C. circuit, but in no case is it advisable to use a voltage transformer connected across the main A.C. circuit for tripping purposes.

The auxiliary tripping circuit is usually energised by means of primary batteries or accumulators in the sub-station, and it is very essential that the batteries be given a great deal of attention, as otherwise they might fail to give the required voltage for tripping in case of fault.

Referring specially to the balanced-voltage method, the special points to be kept in mind in deciding on the suitability of this protective apparatus to deal effectually with all kinds of faults, and yet to remain inoperative under all conditions of overload or surges, are :—

1. The fault current at which the gear is to operate must be well within that expected in case of breakdown when the minimum plant is running in the generating station.

2. The maximum short-circuit current to be expected through a healthy feeder when the maximum available plant on the system is in operation, should not be large enough to raise the voltage

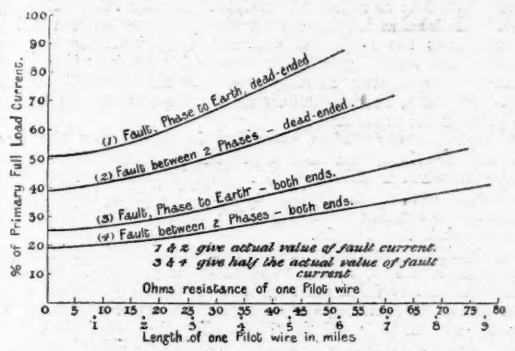

% of Primary Full Load Current.
(1) Fault, Phase to Earth, dead-ended
(2) Faults between 2 Phases – dead-ended.
(3) Fault, Phase to Earth – both ends.
(4) Fault between 2 Phases – both ends.
1 & 2 give actual value of fault current.
3 & 4 give half the actual value of fault current
Ohms resistance of one Pilot wire
Length of one Pilot wire in miles

FIG. 4.

between the pilot wires to a value endangering the safety of the pilot-wire insulation, or to cause a capacity current in the pilot-wire circuit sufficient to operate the relays. Considerable margin must be allowed for any extraordinary high-frequency phenomena which may be expected on the system.

3. The series transformer secondary voltages have to be balanced with extreme accuracy against each other, so that even under the conditions mentioned under point (2) they will not be able to force enough current through the pilot-wire circuit to trip the relays.

Considering point (1) in connection with a three-phase system protected as shown in fig. 5, it should be noted that a different size of fault current is required for tripping, depending upon whether the feeder is fed from both points A and B ("both ended"), or from one side only, say from A ("dead ended").

The ratios between the values of fault current required for operation under different conditions depend upon the relative impedance of the transformer and relays compared with the resistance of the pilot wires. Some typical relative values are given in the curve, fig. 4, which shows test results.

In badly designed systems it may easily happen that the gear will operate when fed from both ends, but will not operate "dead

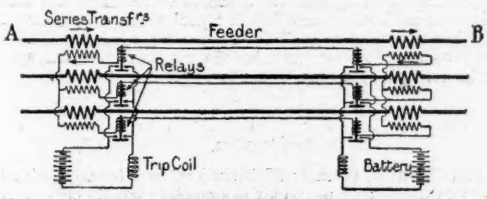


FIG. 5.

ended." In connection with this it should be noted that the fault to earth is often limited by a resistance in the neutral of the generator or generators.

Passing now to point 2, the voltage between pilot wires, in the opinion of the authors, should not, under the heaviest conditions of short-circuit, exceed 700 to 800 volts. The general characteristics of the pilot cable are as follows :—

(*a*) Size of each core 7/21½ S.W.G. Low-tension three-core cable, paper insulated and plain lead covered.

(*b*) Capacity of any one core to the other two connected to earth, 0·27 microfarad per mile, and of the three cores bunched together, to the lead, approximately 0·51 microfarad per mile.

(*c*) Self-induction of one core, 0·53 millihenry per mile.

(*d*) Resistance per mile of each conductor, 8·7 ohms at 20° C.

(*e*) Thickness of dielectric between conductors and between conductors and lead, 0·09 in.

(*f*) Insulation test guaranteed by the makers, 2,500 volts.

In a feeder 6 miles long the maximum capacity current to be expected in the pilot wire on a 50-period circuit would be 0·2 ampere with 700 volts between the pilot wires, half of this being supplied from the series transformers at each end.

The authors consider that the current at which the relays operate should not be less than about four times the maximum capacity current; thus the minimum current at which the relays can be set to trip for a 6-mile feeder would be 0·4 ampere, providing the design is for 700 volts maximum voltage. If the maximum voltage obtainable is less or the feeder shorter, the relays can be set correspondingly lower.

Regarding point 3, this is mainly a question of accurate testing and adjustment of the magnetic circuit of the series transformers. Each transformer must be tested against a standard back to back. Even if two transformers should have exactly the same secondary voltage with the same primary currents, still the phase difference of the secondary voltage may be sufficient to cause tripping at heavy overloads should these two transformers be connected back to back.

The above remarks have been made with special reference to the arrangement shown in fig. 5, where three pilot wires and three relays at each end are used, but they can be applied generally to any balanced-voltage arrangement.

The reliability of the balanced-voltage system can be increased and the maintenance reduced if in place of direct-current tripping, alternating-current tripping be adopted where the tripping is directly dependent on the current flowing under fault conditions. Against the use of the alternating-current trip it has been urged that the relays require to be more robust, due to the greater volt-amperes required by the alternating-current trip coil; but this is not really important, particularly as the relays have only to close the circuit and not to break any current.

A further improvement and reduction in maintenance for the Merz-Price protection is obtained by an arangement which does away with both relays and batteries, and which approaches the simple conditions existing when the gear is applied to transformers. Referring to the single-phase case of fig. 7, it will be seen that the principle is that of the balanced-current system whereby equipotential points (under healthy conditions) are obtained in each station by means of tappings from the transformer secondaries and additional resistances. In the diagram the centre point of each transformer is shown connected to the end of a small resistance, which is approximately equal to the resistance of one of the pilot wires. Under normal conditions of operation, the middle point of the secondary of the series transformers is at the same potential as the end of the resistance, and consequently the trip coil may be connected across these two points without any danger of tripping under all conditions of load. Immediately a fault occurs in the section of the feeder protected by the two series transformers, the middle point of the series transformer and the end

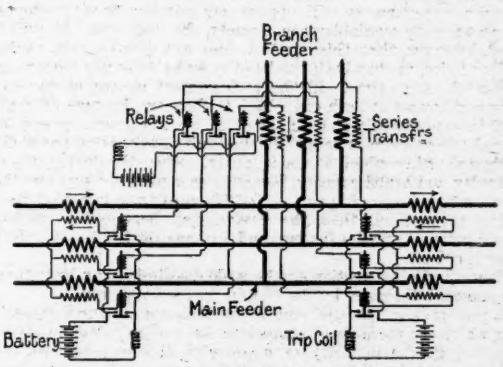


FIG. 6.

of the resistance are no longer equipotential points, and current flows through the trip coil, thus tripping the switch. It should be noted that it is not necessary to connect the middle point of the resistance to the middle point of the series transformer, but that several points of equipotential occur in series transformer and resistance, and the trip coil may be connected across any of these points; for instance, one-third of the resistance may be connected to one-third of the secondary winding of the series transformer, or three-fourths of the resistance and the secondary winding of the series transformer may be connected.

This method of tripping (for which patent rights have been applied for) has, in the opinion of the authors, advantages over those previously proposed, which may be recapitulated as follows :—

1. No relays are necessary, these being replaced by small resistances. The fact that no relays are required, apart from the question of reliability and maintenance, is advantageous, in that, when this protection is used in fiery mines, there is no danger from the spark caused by the operation of the relay.

2. The direct-current tripping requiring batteries is entirely abolished.

3. There is no necessity for the accurate balance of the secondary voltages of the series transformers, and hence series transformers throughout the system can easily be interchanged, and there is no possibility of the balance being disturbed due to mechanical injury or bad handling of the series transformer. Further, there is no danger of the transformers supplied for extensions, say, 10 years after the original installation, being out of balance.

4. A break in the pilot wires immediately results in the feeder being cut off, thus doing away with any possibility of false security.

Fig. 8 shows a method of adapting this to a three-phase circuit, using only two pilot wires and one trip coil at each end. For the connection with two pilot wires it is necessary to make the trans-

former in one of the phases different in ratio and output to the others, or to use two series transformers in one phase.

When a feeder is branched from one of the sections equipped with the protective gear, there are two ways of dealing with it; either the current flowing through it can be treated as fault current and the relays on the section set so that they will not trip with the maximum amount of load current flowing through the branch, or three points may be connected up in series, as in fig. 6, and the voltage of the three points balanced instead of two in the ordinary case. If the tapping is very large and the service an important one, it will be necessary entirely to protect the points in a similar manner to a sub-station.

For the second method of protection (fig. 6), it is important that the transformers have straight-line characteristics, even at heavy overloads, since it is only by this means that the voltage at the various points will be proportional to the currents and the sum of these voltages equal to zero.

The protection of parallel feeders corresponds in many respects to the case of the ring main, although in general the conditions are much simpler. In the authors' opinion, the most effective method of protecting parallel feeders is by the use of the Merz-Price gear.

Other methods of protection have been proposed, one of which is shown in fig. 9. This, the authors understand, was introduced by the British Thomson-Houston Co. It is obvious that with the

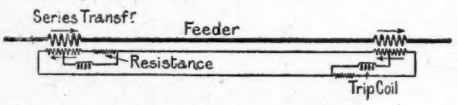


FIG. 7.

series transformers interconnected as shown at the sub-station end, no potential will exists between points *a* and *b*, provided the secondaries of the two transformers are carrying the same currents; thus no current will flow through the trip coil connected across points *a* and *b* under normal conditions. If, however, a fault occurs in one of the feeders, then the currents in the primaries of the two series transformers flow in opposite directions, since the healthy feeder will feed into the faulty one and the secondary voltages of the series transformers will oppose one another, forcing current through the only available path, namely, the trip coil. It will be noticed, however, that this method does not discriminate as does the Merz-Price, in that both the healthy and the faulty feeders are cut off at the same time. If the arrangement shown at the sub-station end is used at both ends, both feeders are, in case of fault, cut off instantaneously at both ends. If on the generator end the balanced relay shown is used, only the faulty feeder is cut out at this end, thus showing which feeder is faulty. Since the device cuts off both faulty and healthy feeder, it cannot be used as a discriminating device for two feeders in parallel, but if more than two feeders are running in parallel, then the device may be adopted between separate pairs of parallel feeders, and in case of fault one pair of feeders is cut off.

This method of protection can be made discriminating by using an arrangement introduced by the Westinghouse Co. in 1905.

The protection of parallel ring mains does not call for any special comment, as the methods of protection for ordinary ring mains can be applied in the majority of cases with the same success. It should be pointed out, however, that the arrangement at the sub-station end of fig. 9 can be applied with better success to parallel ring mains than to parallel feeders.

In the above system it is necessary to have small auxiliary switches on the oil-switch mechanism to cut out the protective gear during switching operations, otherwise individual feeders cannot be switched on to bus-bars already loaded. Further, when one feeder is cut out the other requires some additional protection, so that the systems are not self-contained, as is the Merz-Price system.

The majority of transformers have been constructed with air gaps in the magnetic circuit, and the authors believe that most of

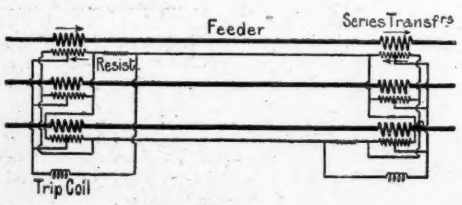


FIG. 8.

the series transformers used for protection on the North-East coast are either so constructed or have been provided with resistances in parallel giving them similar straight-line characteristics. The advantage of an air gap in the magnetic circuit is that the impedance of the series transformers is greatly reduced, and when one transformer has to force current through the opposing series transformers, as in the case of "dead ended" faults, this reduced impedance is of great value in lowering the operating current. Series transformers without air gaps can, however, be used, and are particularly applicable to low periodicity systems. The advantage of using series transformers without air gaps is that the transformers are easier to balance and easier to keep in balance than transformers with air gaps. Where such transformers are used it is advisable to connect them in delta in order to reduce the impedance of the pilot wire circuit. Where three points are protected, as in fig. 6, transformers with air gaps must be employed, as straight-line characteristics are essential.

Series transformers having only one primary turn have been largely used. This type of transformer is particularly suitable to the "balanced-voltage direct-current trip" system, since the volt-ampere output of the series transformer required is very small. The transformer used by the Westinghouse Co. is of the ordinary series type, with the exception that a specially strong mechanical construction has been adopted to prevent alteration of the air gaps due to rough handling.

The relays are usually constructed in a very simple manner and call for little comment. The British Thomson-Houston Co.'s and the Westinghouse Co.'s relays are very similar in construction. In the Westinghouse construction the weight of the armature is counterbalanced by an adjustable weight. On the relay tripping, an indicator falls, and denotes on which phase or between which pair of phases the fault has occurred. The indicator may be returned to its normal position by means of a knob on the top of the case without opening the relay cover. In the British Thomson-Houston Co.'s relay the trip-coil circuit is closed at two points, one at each end of the armature.

The Reyrolle relay differs somewhat in form from the two previously described, and is not arranged for automatically re-setting itself when a fault is cut off. This latter feature serves as an indicating device, and renders a special indicator unnecessary, but necessitates opening the case and re-setting the relay before the opened switch is closed again.

Relays which automatically re-set themselves have the advantage of breaking the battery circuit when the fault is cut off, and this prevents the battery from running down too quickly. When non-automatic resetting relays are used, the battery circuit may be broken by an auxiliary switch on the oil-switch mechanism, but this introduces another link in the circuit which is liable to get out of order.

Conclusions.—1. The Merz-Price protective gear is the most satisfactory discriminative device at present produced, for transformers in parallel, for feeders in parallel, and for ring mains.

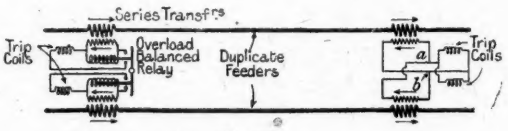


FIG. 9.

The main advantages are instantaneous operation and isolation of the faulty sections only, whilst it can be adopted for all conditions.

The gear renders possible freer lay-outs of the cable system than does any other protective gear, and due to its adoption more economical distributing systems may be used.

2. This protective gear can be applied in many ways, but the best form, owing to its simplicity and safety, is the balanced-current system.

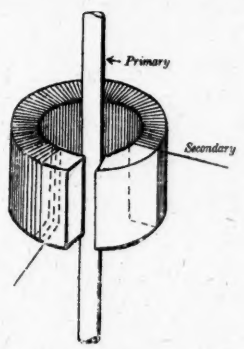
3. For feeder protection the system developed by the authors has all the general advantages of the balanced-current systems, and is specially immune from trouble due to capacity currents in the pilot wires. The use of only two pilot wires for three-phase feeders, and the fact that no relays or batteries are required, give the system decided advantages over those hitherto used.

DISCUSSION.

MR. P. V. HUNTER (Merz & McLellan) wished to emphasise the pressure rise which took place on the secondary windings of current transformers, due to severe overloads occasioned by faults on the system. The authors' paper showed this abnormal pressure to reach 600 or 700 volts across the terminals of the current transformer; hence special precautions had to be taken to prevent insulation breakdowns between turns on the secondary. Generally speaking, such a breakdown would not be discovered immediately, since the transformer ratio might not be sufficiently altered to operate the relays at ordinary loads. If, however, a second fault occurred elsewhere in the network, the protective gear on the faulty section would operate and also that in the section containing the faulty transformer secondary. Such a circumstance might result in shutting down a large part of a network. He then referred to the importance of designing balance gear for fault conditions, and not for what was ordinarily understood as full-load conditions. It was of the utmost importance that the balanced protective gear should not break down under any conceivable rush of current which might accompany a fault—in fact, protective gear on a mains system should be capable of being run safely for an appreciable length of time under the maximum momentary fault conditions. Ordinary current transformers designed for the comparatively small load represented by the full load of the apparatus protected, would be liable to explode under extremely severe fault conditions. There were hundreds of ways of connecting up protective apparatus on the Merz-Price system, but the only arrangements used commercially on a large scale were those shown in diagrams 3, 5 and 6. These three diagrams had been used extensively, and the transforming apparatus protected in that way exceeded 50,000 KW., including about 500 miles of high-tension cable. Fig. 8 was claimed to be an improvement on fig. 5. It was stated in item 4 that a break in

the pilot wire immediately resulted in the feeder being cut off. This was only true if there was sufficient current to operate the relays, and as this current was usually full-load current, it was very probable that the feeder would not be cut off, until a fault elsewhere in the system produced sufficient current to operate the relays. The most serious objection to the authors' arrangement was the number of parts which had to be balanced; fig. 8 contained 14, whereas, in the ordinary voltage balancing gear there were only six parts to be balanced. The voltage-balanced system was one exclusively used on the North-East coast for feeder protection, and the actual primary input of the 6,000-volt transformers was 5 volt-amperes, not 41 as given by the authors. The reason for the voltage balancing protective gear having an output of 5 volt-amperes, was that it had been designed to work continuously with maximum fault current. He did not think that any apparatus which the authors put forward would work under these conditions for a minute without using a large amount of material in construction, and thereby making the whole apparatus extremely cumbersome and expensive. In designing protective gear the great point was to forget full-load current and design absolutely for maximum fault conditions.

MR. H. W. CLOTHIER (Messrs. Reyrolle) had been associated with Mr. Price in the design of the Merz-Price protective systems, and agreed with the authors that the aforesaid system was the right one to use on H.T. networks. In support of this opinion he exhibited a piece of three-core H.T. cable (sent by Mr. Lackie, Glasgow) which had developed a short between two phases. The system was so well protected that the fault was cleared before the outer dielectric of the cable was pierced. Incidentally, this example was of particular interest in view of the discussion on clearing faults in mines quickly enough to avoid flashing external to the cable. Similar cable faults had occurred in places which were not protected by balanced-protective gear, and complete shut-downs for lengthy periods had been occasioned. The current transformers used on the 6,000-volt networks in Newcastle were of the simplest possible type. An annular iron ring having an air-gap was wound with a number of well insulated turns, which constituted the secondary winding. The primary was a simple bar of copper passing through the centre of the ring. The straight bar construction permitted the standardisation of these transformers at very high currents, which was not convenient with wound primaries; moreover, the air-gap permitted



SINGLE-BAR TRANSFORMER.

an easy adjustment during standardisation. The primary input was less than 5 volt-amperes, as compared with the authors' 41 and 125 volt-amperes. This transformer differed from that of the authors, in that it possessed a straight line characteristic up to 20 or 30 times full-load current, and thus, in contradistinction to the authors' design, it was suitable for use with tees. At least 1,000 of these transformers were in every day use, and not a single case of insulation failure had been discovered. The relay shown was the first design of relay made for this work in England. Many engineers preferred not to rely on a single contact, and in consequence of this requirement a small weight was released when the first contact was made. This weight in turn hammered home a second contact in parallel with the first, and so added an element of security to the operation, in addition to avoiding sparking at the relay contact. Contrary to the authors' inference, these relays would automatically reset, as it was only necessary to remove the auxiliary weight in order to obtain this feature. Contrary to the impression of the authors, current balancing had been used in conjunction with feeder protection, the system (now abandoned) being known as neutral-wire balancing. The proposal shown in fig. 8, which eliminated relays and the auxiliary trip, was particularly interesting, and would be exceedingly useful if the system could be adopted without involving an excessive primary input to the series transformers at normal load. The normal input of these transformers was 125 volt-amperes, and although only 6 per feeder were shown in the diagrams, the text proposed 8. When compared with the six transformers with an input of 5 volt-amperes each as used at Newcastle, the waste energy more than compensated for the initial cost of relays and batteries, and the saving of one pilot wire could just as easily be effected with the voltage balancing arrangement. In support of relays and auxiliary trips, it was very advisable to operate the switches periodically by means of the trip gear, and so prove their satisfactory working.

MR. E. B. WEDMORE (B.T.-H. Co.) considered that the commercial merits of the Merz-Price system were not sufficiently recognised, and that in due course people would realise the debt which the industry owed to Messrs. Merz and Price. The circulating-current system shown in a number of the authors' figures had been independently developed by the B.T.-H. Co., and used extensively for a number of years. The same company had under consideration the advantages of the circulating-current system as applied to feeder protection, and methods had been developed to compensate for pilot wire drop and capacity current in the pilot wire, similar to those illustrated by the authors. He wished to emphasise the importance of the question of heating in current transformers, referred to by Mr. Hunter. Several instances had been known where current transformers had violently exploded under fault-clearing conditions. He wished to point out that the defects found by the authors in connection with fig. 9 were due to the omission of certain items from the diagram. In order to make the arrangement discriminate, it was only necessary to add reverse-current relays normally short-circuiting the respective trip coils. The reverse-current relay of the present day was a very different device from that which Messrs. Merz and Price had condemned. The relays used in the B.T.-H. system were designed to give large forces operating with extreme rapidity on small currents, even at quite low voltages, and would operate on current values much smaller than could be considered in connection with the Merz-Price system. About 200 of these relays were now in use on generators and feeders, and had not only met all service conditions, normal and abnormal, but had been very severely tested by some of the users and also by severe faults in service. In small industrial towns where customers were small power users and capital cost an important consideration, the consuming points could not be readily predetermined, so that the most economical ring main system could not be laid out; moreover, owing to the necessity of confining cables to available streets, it would often be impossible to adopt the theoretically best system of conductors. In such cases, a parallel feeder system could be employed with advantage, the feeders being connected together at the generating station only, and each customer furnished with switches for connection to either system, but arranged so that connection could not be made to both systems at once. The expenditure required for the employment of discriminating gear on such a system would not be justified, but as the feeders were all open ended, one might, with great advantage, employ leakage protective apparatus at the generating station alone. He referred to the balanced-core system of leakage protection, by means of which individual feeders might be disconnected instantaneously on leaks developing, representing a small fraction of the normal load current. This arrangement had great advantages. An earth resistance of high ohmic value could be employed, ensuring that the fault currents were limited to a fraction of the normal load current. It often happened that a heavy fault so distorted the voltage triangle at the generating station, that individual induction motors and other apparatus in all parts of the system fed back to the fault and cut themselves out of service. This feature could not be directly dealt with by the employment of the Merz-Price system of protection, but by the employment of a leakage system and a high resistance to earth the trouble was eliminated. With very few exceptions, faults developed first as faults to earth, so that on this system serious disturbance was practically eliminated. The disconnection of faulty sections without calling for the development of heavy short-circuit currents relieved the system also of the inevitable static strains due to violent changes of current value.

MR. A. E. MCKENZIE (Manchester Corporation) said that in Manchester there were two 4,000-KW. generators which had been protected by this gear for the past two years. Previous to its installation much trouble was experienced by faults starting between turns in the same coil, and subsequently developing to earth. After rewinding the generators the protective gear was installed, but since no trouble had arisen since that time, the gear had not been called upon to operate. It could not be used to protect generators against loss of field, but this fault was rare. No automatic devices tried at Manchester had given satisfaction under all conditions, but the balanced system had most advantages. At the present time the 6,000-KW. alternators were connected solid to the bus-bars, but the Merz-Price gear was shortly to be fitted. He did not consider it necessary that generators should always be cut out immediately a fault occurred between different parts of the same phase, as on several occasions he had found coils welded together when the armature was opened for rewinding. In the speaker's opinion the alternative to the Merz-Price protection for generators was no protection at all. He agreed with Mr. Clothier as to the advantage of tripping coils operated by an auxiliary circuit, in order to test them regularly. The relays on the generators at Stuart Street were frequently closed in order to open the switches when the generators were being taken off load, and so prove their satisfactory working. Most of the H.T. feeders were laid in Manchester before the balanced system was known, but pilot wires had been laid with all cables recently installed. When duplicate feeders ran to the same bus-bars in a sub-station, relays were installed, and had always answered very well. Some years ago, when it was not fully understood how long it was possible to run a H.T. fault, the Stuart Street relays were set at 20 seconds. These relays were now set absolutely instantaneous. It was at first thought that the instantaneous setting would cause the main feeder breakers to be operated by momentary rushes due to faults on the L.T. network, but hitherto no trouble had been experienced in this direction. The relays were set to operate at twice the normal full-load current of the feeders, and occasionally pieces of three-core '15 sq. in. cable, lead-covered and armoured, had been burnt away for a distance of 1 ft.

The AUTHORS, in reply to Mr. Hunter, stated that in addition to very extensive shop tests, and even before deciding to become licensees of the Merz-Price patents, they had obtained information regarding the difficulties met with in Newcastle and also in the first installation in Germany. Regarding the authors' proposed

system, no doubt Mr. Hunter would agree that in case of a break in a pilot wire the gear would operate (instead of leaving the feeder unprotected as in the balanced voltage system) even if a large current was required for such tripping. If, as the authors proposed, normal full-load current only was required for such tripping, the advantage was obvious. In a case such as that of the North-East Coast, it would be well understood that for tripping a fault, a current many times larger than full-load current was required, but on small systems this might result in the gear not operating even in case of dead short. This explained the discrepancy between the 5 volt-amperes input and 41 volt-amperes input referred to by Mr. Hunter. A fair comparison could only be made by taking the volt-ampere input at a current corresponding to the fault current required to operate under the least favourable conditions. If this fault current was three times the normal full-load current, the input of the series transformers on the North-East Coast system would be 45 volt-amperes. In the proposed system there were two losses, viz., in the series transformers and in the pilot wires. Both together would not exceed 5 per cent. of the feeder loss, assuming a 200-ampere feeder. If the feeder loss was 2 per cent. at normal full-load current, the loss in the protective gear would be approximately 01 per cent. If operation at a larger fault current than normal full-load current was satisfactory, the losses would be correspondingly decreased, so that this point was of no importance. As to Mr. Clothier's criticism of the relay, the time element of the relays was negligible as compared with that of the switches themselves, and any further increase in sensitiveness would render the relays liable to operation by vibration. As to Mr. McKenzie's remarks, it should have been stated that the Merz-Price gear should not be used for generators except in conjunction with other protection. It was certainly advisable to protect against loss of field and loss of power, and in case of failure between different parts of one phase, the machine should be cut out at once, otherwise abnormal strains might be put upon the remainder of the plant. Further, if the generator was cut out before the fault developed into an earth, the damage to the generator itself would be minimised.

BUSINESS NOTES.

Book Notices.—*Willing's Press Guide and Advertisers' Directory and Handbook.* London: James Willing, jun., Ltd. 1s.—This is the thirty-eighth year of publication of this very cheap and conveniently-arranged Press directory. In the general alphabetical section, which occupies a large portion of its pages, you can find what you want at once. Other classified and geographical sections follow.

"*Transactions* of the South African Institute of Electrical Engineers." Vol. I, Part 12. November, 1910. Johannesburg: The Institute. Price 2s.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVI, No. 10. December, 1910. New York: The Society.

"Post Office Electrical Engineers' Journal." Vol. III, Part 4. January, 1911. London: H. Alabaster, Gatehouse & Co.

"*Transactions* of the Illuminating Engineering Society." Vol. V, No. 9. Easton, Pa.: The Offices of the Society. Price 75 cents.

"Engineers' Pocket Dictionary." English-German-Dutch. By W. H. Steenbeek. London: Whittaker & Co. Price 2s. net.

Calendars and Catalogues. — Messrs. Ferranti, Ltd., of Hollinwood, Lancs., have brought out a wall calendar which is quite different from everything else that we have seen for 1911. The monthly slips for the year are mounted upon a stained wood base instead of the usual card, and the name is neatly printed in gilt lettering which makes an effective appearance of the whole. A half-tone view appears of their non-metallic motor starter.

Messrs. Poulton & Son, of Reading, have issued a wall calendar for 1911. Small coloured drawings are arranged above the date slips, showing the firm's patent system of boiler setting.

The Forest City Electric Co., of Collier Street, Greengate, Salford, have issued a hanging calendar consisting of monthly sheets bearing dates in large figuring. Illustrations of manufactures appear in the upper half of each sheet.

Messrs. Mavor & Coulson, Ltd., of Glasgow, have issued a calendar with bold figuring on monthly slips.

Messrs. J. W. Brooke & Co., Ltd., Adrian Works, Lowestoft.—36-page catalogue (fully illustrated) dealing with the "Brooke" marine motors and motor-boats.

Messrs. Krupka & Jacoby, 11, Queen Victoria Street, London, E.C.—Several new leaflets dealing with and giving prices of Silvertown Leclanché cells, new "Flat" type tumbler switches, Holophane reflectors and tantalum lamps.

Messrs. Litholite, Ltd., 55, Hackney Grove, London, N.E., announce reduced prices for some of the lines in their catalogue sheet No. 17.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—New leaflet, No. 93, showing and pricing their oil-cooled totally-enclosed motor-starters.

General Electric Co., Ltd., 67, Queen Victoria St., E.C. Sections X and Y of Catalogue, dealing with low and medium tension switchgear, and giving full particulars and prices of the Peel and Witton switches, new Tandem switches, a new knife switch of small capacity (the "Leader"), and a variety of multiple-contact switches, cut-outs, terminal sweating sockets, the new "Record" automatic battery switch, circuit-breakers, house-service cut-outs, &c., with a series of fully dimensioned drawings. Also a leaflet describing the "Pixielite" strip, which will be in demand for Coronation illuminations.

Messrs. Thomas Bolton & Sons, Ltd., of 57, Bishopsgate, London, E.C., announce that owing to the increasing demand for bronze in all forms, they have been making extensive experiments with a view to producing the best possible article for the different purposes for which this class of material is required. They have issued a list of the different bronzes which they are now making at their Birmingham and Oakamoor Works, and which they are offering in large quantities.

Messrs. Siemens Bros. Dynamo Works Co., Ltd., 39, Upper Thames Street, London, E.C.—Large postal card giving a table of prices of quick-break knife switches up to 650 volts.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W.—Supplement No. 2 (Catalogue 520) describing a high-tension telephone for use on telephone lines running in proximity to H.T. circuits.

Mr. Wm. Riley, 30, Lime Street, London, E.C.—Forty-page catalogue of the vitrified clay conduits of the H.B. Camp Co., of Pittsburg, for whom he is agent in the United Kingdom.

Messrs. Simplex Conduits, Ltd., Birmingham and London.—Twelve-page illustrated catalogue of various kinds of measuring instruments, including both switchboard and portable types—the former comprising moving iron voltmeter and ammeters, moving coils, hot wire ammeters and voltmeters, and dynamometric watt-meters. The same range of instruments are included in portable types with the addition of galvanoscopes and Wheatstone bridges. Switchboard types of instruments are of a flange type, open dial or cast-iron type, and have special terminals which are interchangeable so as to allow of their being used for either back or front connections. Copies of the catalogue may be obtained from the Testing Department, Garrison Lane, Birmingham.

British Attention to Turkey.—In the current issue of the *Quarterly Journal* of the British Chamber of Commerce of Turkey, we observe that among the new members is "Mr. Robert S. Rowell, managing director of the British Agencies Association, Constantinople." In an advertisement announcement on another page of the *Journal*, we find that this Association consists at present of the following firms for whom Mr. Rowell (Union Han, Galata, Constantinople) is acting as managing director for Turkey, Roumania, Greece, Servia and Bulgaria:—

Thos. Firth & Sons, Ltd., Sheffield.
R. & W. Hawthorn, Leslie & Co., Ltd., Newcastle-on-Tyne.
Birmingham Small Arms Co., Ltd.
Kerr, Stuart & Co., Ltd., London.
Dick, Kerr & Co., Ltd., London.
Callender's Cable & Construction Co., London.
Cotton Powder Co., Ltd., London.
Hulse & Co., Ltd., Salford.
Birmingham Metal & Munitions Co., Ltd.
John Musgrave & Sons, Ltd., Bolton.

We hope that this Association and the electrical and engineering firms represented by it will reap a great reward from their new efforts in a country where, as we have frequently shown, there are now numerous excellent business opportunities at hand. A full description of the prospects in Turkey appeared in the Electrical Review, October 8th, 1909. The advice of Sir Adam Block for British manufacturers to associate with each other in concentrating on this market, was published in the Electrical Review, April 15th, 1910, in an article on "The Need for British Trade Aggression in Turkey." We have not any doubt of the practicability of such arrangements being carried out with success in other markets concerning which Consuls and our humble selves have advocated it again and again. The article on "Extending British Engineering Abroad," by Mr. E. T. Williams (Electrical Review, November 25th, 1910, p. 851), aroused interest among several of our manufacturing and trading firms, and we hope that it may be found possible in combination to do good business where individual firms would find it too expensive to act alone in the first instance.

Electric Pumping Plant.—Messrs. Scott & Mountain, Close Works, Gateshead-on-Tyne, recently received orders for several pumping plants, comprising large centrifugal pumps, two of the most interesting of these being for Messrs. Cochrane & Co., Stanghow Mines. These two sets of plant consist of four-stage high-lift centrifugal pumps to deliver 750 gallons per minute against a total head of 400 ft., complete with three-phase 3,000-volt motors and the necessary generating plant in duplicate driven by high-speed reciprocating steam engine. For Messrs. Elswick Coal Co. they are supplying one pumping unit consisting of a centrifugal pump to deliver 2,000 gallons per minute against 200 ft. head, driven by a direct-current motor, this set being required for practically continuous working; it is run at a speed of only 750 r.p.m. In both of these cases the plant is of the type which Messrs. Scott and Mountain have recently introduced, and embodies all their latest improvements.

British Firms Co-operating in Canada.—Our contemporary *Canada* states that a co-operative association of many of the largest wholesale houses in England will this year make Regina their distributing centre for Saskatchewan. The association will be capitalised at $250,000. The organisation, which has written to the Greater Regina Club explaining its plans, is entirely new, and will be made up of many large wholesale houses in the British Isles. They will make up a special train of ten coaches, which will tour Canada from Montreal to Vancouver. Each department that is to have part in the co-operative association will send an expert along with the train, which will stay for a week in each of the principal cities. Merchants will be invited to visit the train and inspect the displays. At each of the cities that have been chosen as

distributing centres the experts in charge will establish branch houses. Considerable correspondence has passed between the Greater Regina Club and the promoters of the big concern, and it was on representations of the club that Regina was selected as distributing centre for Saskatchewan. The location of the building, &c., will be decided by the experts when they arrive there. This is the first enterprise of the kind which British capital has yet established in Canada. The idea is to take advantage on an extensive scale of the preferential tariff to place British goods before the Canadian consumer. The ELECTRICAL REVIEW hopes that these wholesalers count among their number some representatives of electrical and other engineering trades.

Trade Announcements.—Mr. Alex. C. Scott ceases to be a director or a shareholder of MESSRS. HASLAM & SCHONTHEIL, LTD., Cardiff, from 14th inst., he having resigned in order to take up another position. The style of the company will remain unchanged, and Messrs. Haslam and Schontheil will continue to act as joint managing directors.

THE MIDLAND ELECTRIC MANUFACTURING CO., LTD., have arranged with Messrs. S. Thomas Pemberton & Co., Council Chambers, Colmore Row, Birmingham, to act as sole representatives in the Midlands for their manufactures from January 1st.

THE BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, announce that they have opened a branch office at Castle Buildings, Swansea. The telephone number is 123 Central, and the telegraphic address "Asteroidal, Swansea."

MESSRS. CLARKE, CHAPMAN & CO., LTD., of Gateshead-on-Tyne, have withdrawn their office from Westminster, and the business will be carried on at their present London address, 50, Fenchurch Street, E.C., under the managership of Mr. H. R. Chapman.

MESSRS. DAVID BROWN & SONS (HFD.), LTD., Park Gear Works, Lockwood, Huddersfield, have recently installed at their works a special plant for cutting double helical wheels direct from the solid with continuous teeth. By their method of cutting it is claimed that the centre or "V" portion is retained, thus adding greatly to the strength and efficiency of the gear. The firm have also secured the sole rights for the construction of these machines.

MESSRS. ENGINEERING INSTRUMENTS, LTD., of Skerne Works, Darlington, announce that they have appointed Mr. R. Steel, late of Messrs. R. Steel & Co., to look after their interests in Scotland. His address is, for the time being, 38, Bath Street, Glasgow. Mr. Steel sends us a similar announcement regarding his movements.

Messrs. Pemberton & Clark, of Colmore Row, Birmingham, have been appointed Midland district agents for the "D.P." BATTERY CO., LTD., in place of Mr. J. Hilton, the latter having joined the staff of Messrs. Bruce Peebles & Co.

MESSRS. GENT & CO., LTD., of Leicester, announce that Mr. A. E. Eats, who has lately been their Newcastle manager, has now been appointed their London manager. For some years previously Mr. Eats held a position in the electrical department of Messrs. W. H. Allen, Son & Co., Ltd., of Bedford, and he is conversant with all specialities for general, marine, and municipal requirements.

MESSRS. FELD BROS. & CO., LTD., of 25, Budge Row, London, E.C., have taken over the sole agency for Great Britain and the Colonies for Messrs. Brenne, Hangarter & Co., Haspe, Westfalia, for permanent magnets.

MESSRS. SMITH, MAJOR & STEVENS, LTD., have removed from Battersea to more extensive premises at Abbey Works, Northampton.

Fire.—On Thursday morning last week a fire occurred at the works of MESSRS. BERRY, SKINNER & CO., manufacturing electrical engineers, Oozells Street, Birmingham. The damage done was comparatively slight.

Dissolutions and Liquidations.—WARD & COX, electrical engineers, Castleford and Dewsbury.—Messrs. H. Ward and C. J. Cox have dissolved partnership. Mr. Ward will attend to debts.

ELECTRO-MEDICAL INSTITUTE, LTD., Salford. — Liquidator released (J. G. Gibson) December 13th, 1910.

South African Imports.—The *British and South African Export Gazette* states that the machinery imports into South Africa last year were nearly double those in 1909, amounting to fully £3,500,000, against less than £2,000,000. Mining and electrical machinery were the principal classes imported.

Western Australia.—Official reports from Western Australia state that trade there is greatly improving, and that the prospects for 1911 are very encouraging. The remarkable revival in the gold-mining industry, the large prospective harvest of grain, and the increasing population, indicate prosperous times in the coming year.

Private Meetings.—ARTHUR SHARROCK ROBSON, trading as William Robson, Albany Buildings, 347-349, Lord Street, Southport, electrical engineer.—A meeting of the creditors interested herein was held on 3rd inst., at the debtor's premises, when a statement of affairs was presented showing liabilities to the extent of £2,403. There were unsecured creditors for £1,308, and cash claims for £262. In addition there were fully secured creditors for £8,592, the securities held being valued at a like amount. The assets were estimated to realise £2,080, from which had to be deducted £100 for preference claims, leaving net assets of £1,979, or a deficiency of £424. The London City and Midland Bank appeared on the statement as unsecured creditors for the balance of £883. The fully secured creditors were the mortgagees of the premises. There was a first mortgage, with interest, of £6,997, and a second mortgage, with interest, of £1,595. The accountants pointed out that the deficiency appearing on the statement was more than accounted for by the amount written off the assets. The business was formerly carried on by the debtor's father, who built the shop premises. His father died in 1898, and the business was then continued for the benefit of the widow. The latter died in 1898, and the business was then taken over from the executors by the debtor and his brother. The purchase price of the assets taken over by the brothers was £10,600, made up as follows:—Value of premises, £5,000; stock in trade, fittings, &c., £3,261, and book debts, £2,338. The debtor and his brother carried on the business in partnership up to the early part of 1900, when a dissolution took place. The brother then retired, and received a sum of £3,800 as his share of the concern. The debtor took over the business for himself, and agreed to discharge the trade liabilities, which were then in excess of £1,000. He also took over a mortgage of about £6,000 which existed on the premises. In order to enable him to pay out his brother he borrowed a further sum of £500 from the mortgagee, and also obtained an advance of £2,000 odd on a second mortgage on the premises. In addition, the debtor borrowed £500 from his father-in-law. At the close of 1900 the second mortgage of £2,400 was called in, and in order to discharge the debt the debtor obtained £1,500 from his father-in-law, and transferred the mortgage to him. He also obtained accommodation from his bankers. Trading figures were not submitted, but it was reported that the turnover had been about £4,500 per annum, while the expenses, exclusive of the drawings of £6 a week, had been about £1,200 year. The first mortgage had been pressing for repayment, and had served notice upon the debtor calling in the principal. The debtor was unable to make any offer, and it was decided that the matter should be dealt with under a deed of assignment, with Mr. T. H. Crane, C.A., of Southport, as trustee. A committee of the principal creditors was also elected.

Bankruptcy Proceedings.—A. J. HOLLINGTON, electrical engineer, Barclay Oval, Woodford Green.—January 21st is the last day for the receipt of proofs for intended dividend. Mr. G. W. Chapman, Official Receiver, Bankruptcy Buildings.

W. H. HUNTER, plumber and electrician, Towyn.—A dividend of 17s. 6d. (by composition) is payable, commencing with 5s. on January 11th, at the Official Receiver's office, 4, Queen Street, Carmarthen.

R. E. JOY, electrical engineer (Bristol Electrical Co.), Bristol.—Trustee released (E. E. Deane) October 5th, 1910.

R. E. WALKER, electrical engineer and cycle agent, Hereford.—Trustee released (M. J. G. Scobie), September 21st, 1910.

LIGHTING and POWER NOTES.

Ashford (Kent).—The U.D.C. on January 5th decided to give notice of opposition to the application for a prov. order for E.L. by the East Kent Electric Supply Co., Ltd. The clerk is, in the meantime, to negotiate for satisfactory terms of purchase and protective clauses.

Barrow-in-Furness.—At the T.C. meeting on Monday, it was decided to make the following alterations in the charges for electricity:—

Lighting.—The substitution for the present charge of a fixed charge depending upon the number of lamps in use, *i.e.*, £12 per KW. per annum, payable quarterly, plus 1d. per unit.

Motive Power.—The substitution of a charge of £3 per KW. per annum, payable quarterly, plus 1d. per unit.

Heating.—In the case of a consumer lighting his premises or driving his works electrically, the charge for a supply of electricity for heating to be on a flat rate of 1d. per unit.

Alderman Smith, chairman of the Electricity Committee, in answer to criticism, pointed out that the change was an attempt to induce people to use more electricity, particularly for heating and cooking purposes.

The proposals were approved.

The L.G.B. has formally sanctioned the borrowing of £4,500 by the Corporation for the extension of mains and services.

Bath.—At the last meeting of the City Council, the city electrical engineer was instructed to prepare and to submit to the next meeting of the Committee, a schedule setting out the names of the members of the salaried staff of the undertaking, a general statement of their duties, and the salaries, fees, or wages paid.

Bedford.—The T.C. has revised the prices for public lighting by electricity, as under:—Flame arc lamps, replaced by two incandescents at 11.30 p.m., £19 per annum; white arcs, replaced by two incandescents at 11.30 p.m., £24 10s.; 50-C.P. lanterns "police," £3 16s. 6d.; 25-C.P. ditto, £2 9s.; 100-C.P. ditto, £6 11s. 6d.; 50-C.P. ordinary lanterns, £2 19s. 6d.; 25-C.P. ditto, £1 18s.; 100-C.P. ditto, £5 2s. 6d.

Belfast.—On Monday the Corporation Electrical Exhibition was opened in the Ulster Hall, and will remain open until January 21st. There are some 17 electrical stands, including an electric house, and many well-known English electrical firms, as well as local firms, are exhibiting. As regards the apparatus, &c., on view, the Exhibition is representative of a very wide range of electrical applications suitable for domestic, industrial, medical, and outdoor illuminating purposes, and daily demonstrations of electrical cooking are held in the kitchen of the electrical house.

Bognor.—The Chichester Electric Light and Power Co., Ltd., has withdrawn the application for a prov. order, so far as it relates to Bognor, the local authority having applied for similar powers to supply the town with electricity.

Bradford.—In reference to the proposed sale of electrical fittings by the Corporation, steps are being taken to induce the local authorities not to have anything to do with such a system of trading. The Council of the Bradford Chamber of Trade inclines to the view that the matter is of such importance as to warrant the strongest action by that organisation, which represents all classes of tradesmen. With a view to placing the views of the Chamber before the Electricity Committee, the Chamber has asked the latter to hear a deputation upon the matter.

The chairman and deputy-chairman of the Electricity Committee have been deputed to confer with the representatives of the Gas and Health Committees upon the matter of a suggestion to promote a smoke abatement exhibition in the city. The Electricity Committee has agreed that a special rate of 1d. per unit be charged during the period of two weeks, to be determined upon at a later date, for electricity consumed by customers for any purpose (other than power) on premises where such customers use current for special illumination in connection with the forthcoming Coronation festivities.

Blackburn.—The electrical engineer on January 5th was instructed to prepare a report on the question of electricity extensions, and he was also authorised to organise an electrical exhibition this year.

Canada.—According to an American Consular report, the Brandon E.L. Co. has installed a system of heating mains in the principal business districts of the city. Steam is supplied through wrought-iron pipes, covered with asbestos and supported on roller guides, &c., in a 4-in. thick wood casing, which allows an air space round the pipe. The casing is lined internally with bright tin and bound outside with galvanised wire and coated with asphaltum. It is said that with this arrangement, condensation in street mains does not exceed 5 per cent. of the season's output.

The American-owned Bull River Power Co. is stated to have commenced work; the plant is situated at Bull River Falls, B.C., 13 miles west of Fernie, and 17 miles from Cranbrook, which localities and the neighbouring sawmills and mines, will be served. The company expects to develop 12,600 H.P. in three units, and to erect 100 miles of pole lines.

Cheltenham.—The T.C. has instructed the electrical engineer to prepare plans and specifications for a motor-generator and auxiliary appliances to meet the increased tramway demand, at an estimated cost of £1,285. The Council intends to cancel all the unexpended and unraised balances on the capital account with the exception of £3,000, which will be retained to purchase a feed pump, a boiler and traction set.

Cirencester.—Both the U.D.C. and the C.C. have decided to make formal objection to the application of a company for a prov. order for E.L. The U.D.C. has asked for a deposit of £250 instead of £100; that the compulsory area include Dollar Street; that the Council have the option of purchase at the expiration of 21 years; and that the price of current should be 7d. per unit instead of 8d.

Clayton-le-Moors.—The U.D.C. has decided to have the new Council school lighted by electricity provided that Accrington Corporation succeeds in obtaining a prov. order from the B. of T. for the supply to the district.

Continental Notes.—NORWAY.—The probable expenditure of the Christiania municipality during the next five years is stated to include 3,000,000 kr. for harnessing the Solberg waterfall. The T.C. has passed a resolution authorising the raising of a municipal loan not exceeding 5,000,000 kr.—*Board of Trade Journal.*

Dawlish.—The U.D.C. has passed the plans of a generating station to be erected in the town by a local company for the supply of electricity to the district. The permission of the B. of T. for the use of overhead wires has been obtained, and the supply will be available next May.

Dewsbury.—The Corporation has acceded to the application of the Yorkshire Electric Power Co. for consent to the supply of electricity for lighting purposes to premises in Ravensthorpe in cases where energy is supplied by the company for power purposes, but has decided that it cannot give the company permission indiscriminately to supply electricity for lighting purposes. It will be glad, however, to consider applications in specific cases.

East Preston (Sussex).—The Chichester E.L. Co. has applied to the R.D.C. for consent to its application for a prov. order for E.L. in the parishes of Ford and Climping. The Council has decided to obtain fuller information on the matter.

Farnworth.—The Property Owners' Association has asked the U.D.C. to extend its scheme for lighting cottages with electricity at 6d. per week. The Council has decided to defer the matter until the present scheme has had a 12 months' trial.

Frome.—The Council recently applied to the B. of T. for consent to transfer the electricity works to Messrs. Edmundson, the contractors who installed the works, but two members of the Council and a large printing firm, who are the largest consumers of electricity in the district, have written to the Board urging it to withhold its decision until a full inquiry has been held by an Inspector into the matter. They point out that the proposed transfer does not, in their opinion, sufficiently safeguard the interests of the ratepayers in the event of Messrs. Edmundson being wound up. A meeting of the Council recently held considered the reply to the B. of T. as to the objections presented to the proposed transfer, and, after a long debate, it was approved.

Greenock.—The T.C. Electricity Committee has subjected to much adverse discussion a communication from the Secretary for Scotland in connection with the disposal of the surplus of the electricity department. As a result of the working of the department for the last financial year, the Committee found itself with a surplus of over £3,000 in hand. Of that sum it added £1,200 to the reserve fund and £1,929 was applied to the reduction of burgh rates. The Secretary for Scotland, however, has now stated that all the profits from the department ought to be placed to the reserve fund. It is probable that a deputation will wait upon the Secretary regarding the matter.

Grimsby.—The electrical engineer has been instructed to obtain tenders for improving the lighting in certain parts of the Town Hall. The supply of electricity to the Great Central Railway Co., for the Grimsby Docks, is to be extended over a further three months.

Hartlepool.—At a meeting of the T.C. on the 4th inst. three schemes for street lighting were submitted. The Cleveland and Durham Electric Power Co. offered to continue the existing arrangement for supplying a certain number of the public lamps for a period of seven years for £300 per annum. The annual cost of public lighting under this arrangement would be £1,495. The Hartlepools Gas and Water Co. offered to light with incandescent gas lamps that portion of the town now lighted by electricity for £252 per annum, this sum to exclude the cost of columns, lanterns, lighting, &c., and under this arrangement the cost would be £1,402. The Gas Co. also offered to undertake the whole of the lighting of the borough on the incandescent system, inclusive, for £1,417 per annum. The Lighting Committee recommended the adoption of the first scheme, which, it was stated, would effect a saving of £225 on the average of the past six years. The recommendation was adopted.

Honiton.—The T.C. has decided to confer with Messrs. Purves, of Exeter, with reference to the introduction of the electric light into the town.

Leicester.—The T.C. has adopted the joint report of the Gas and Electric Lighting and Tramways Committees with respect to the electricity supply. The effect of the recommendations is to take away the electric lighting department from the Gas Committee, placing it under the control of the Tramways Committee, which will now be styled the Tramways and Electricity Committee.

London.—HACKNEY.—A worn-out conveyor chain at the electricity works is to be replaced with a chain of modern design and an alteration of the position of the coal storage bunker is to be carried out with the provision for tramway and turntable, at a total estimated cost of £545.

STEPNEY.—A communication has been received from the L.C.C. intimating that it will be prepared to sanction loans for electricity mains in advance of expenditure, subject to details being supplied subsequently, provided that extensions, of mains estimated to cost £3,000 and upwards be made the subject of a separate application. The Finance Committee considers that this request of the County Council is reasonable.

ISLINGTON.—A difference has arisen between the Lighting Committee and Council owing to rejection by the latter of proposals put forward by the Committee with reference to the hiring out of electrical accessories. At the meeting of the Council on Friday last a report of the Committee was brought up, stating that owing to the apparent want of confidence in the Committee shown on this and previous occasions, it, through the chairman, tendered its resignation. The town clerk, replying to a question, said that the Committee's resignation was not binding on individual members. The chairman (Alderman Elliott) ruled that the Committee could not resign as a body, but that each member must withdraw individually. There was some angry discussion upon the point and the meeting terminated abruptly. A member of the Committee subsequently informed the Press that 12 of the members had handed in their resignations.

According to Ald. Vorley, chairman of the Committee, the latter resigned because the report of the Publicity Sub-committee was summarily rejected by the Council.

The report advocated contract lighting and the hiring-out of small electrical apparatus and motors; £500 was asked for, and the scheme was to be closed in 12 months if unsatisfactory. When the proposals were known, 13 applications were received for motors up to 60 H.P. within three days.

MARYLEBONE.—The L.C.C. has decided to appeal to Quarter Sessions against the assessment put on the electricity undertaking. It asks for a gross value of £63,000 and a rateable value of £40,000, as against a gross value of £27,000 and a rateable value of £14,650 fixed by the Assessment Committee. The former rateable value was £7,347. A total of 3,513 public street lamps is now lighted by electricity.

Maidstone.—A question has arisen at Maidstone in connection with the recent fire at the premises of Messrs. Dennis, Paine & Co., drapers, with reference to electrical work carried out by Council employés. The chairman of the Gas Co. has written to the T.C. stating that at the inquest on the boy who lost his life at the fire, evidence was given showing that the installation of the electric light was done by an employé of the Electricity Committee. The writer drew attention to the fact that

in November, 1906, the T.C. agreed in writing not to carry on the business of erecting and installing, for payment or otherwise, electrical fittings and wires, either directly or indirectly. In reply to this the Council states that the employé in question had asked the electrical engineer if he could put up the temporary lamps for Messrs. Dennis, Paine & Co.'s Christmas show. Mr. Hoadley, the electrical engineer, told the employé that he could not do so, but it appeared that Mr. Paine wished the work to be done by the employé in question, and eventually he fixed up the wires in his own time, and was paid by Mr. Paine. No charge was made for work undertaken so far as the Corporation was concerned, and it was added that it was the earnest desire of the Council not to exceed the powers it possessed.

Metropolitan Area.—Metropolitan B.Cs. are to consider the resolutions passed at a recent conference convened by the Islington B.C. *re* the establishment of testing stations and street boxes, &c., in connection with the supply of electrical energy. Twelve B.C.s were represented, and the resolutions adopted were as follows: (1) That it is desirable that the provision of Sec. 41 (3) of the Electric Lighting Clauses Act, 1899, should apply to local authorities in the metropolis, who are electric lighting undertakers, in lieu of the corresponding sections with regard to the establishment of testing stations in their provisional orders; (2) that a committee be appointed to consider and report as to the best way of giving effect to the foregoing resolution; (3) that it be also referred to the committee to consider and report as to the action which should be taken to secure a speedy amendment of the London Building Act, 1894, with a view to removing electric service boxes, placed in the public way by metropolitan local authorities under their statutory powers, from the category of building structure or work within the meaning of Sec. 145; (4) that the question of the desirability for united action being taken to ensure that inspection boxes placed in the public highway shall be efficiently ventilated be also referred to the Committee for consideration and report.

Navan.—A scheme for electric lighting has been decided on, and a site for a generating station obtained, Messrs. Wilkins and Burden, of Dublin, being the consulting engineers.

Newcastle Emlyn.—The D.C. proposes to consider the question of lighting the Aberarad district with electricity.

Nelson.—The Burnley Council wrote to the Nelson Council on January 5th, suggesting that the proposed supply of electricity to Brierfield should be limited to purposes other than tramways, the B. of T. to be notified accordingly. The communication was ordered to be sent to Nelson's Parliamentary agents for their views.

Northumberland.—An important project is, according to a correspondent, being promoted in the East Northumberland colliery district. It is proposed to link up the populous centres of Blyth, Beddington, Ashington and Newbiggin by means of an electric system. The scheme is to be considered at a conference of local public authorities, the object being to establish the system on a municipal basis.

Pontefract.—The T.C. has decided to lease its E.L. order to the Wakefield and District Light Railway Co., on payment of £300, with option of repurchase in 21 years, at the then value. The order, it is stated, would expire shortly.

Portishead.—The Somerset C.C. has referred to a special Committee the application for a prov. order for electric supply by Messrs. Christy Bros. & Co., Ltd., of Chelmsford, for the U.D. of Portishead and adjoining parishes. The application is to be opposed.

Reigate.—The T.C. has decided to have prepared a list of public lamps which can conveniently be converted from gas to electricity. The Electric Lighting Committee offers to carry out the conversions at a cost of £3 per lamp.

Rhondda.—The U.D.C. proposes making an application to the B. of T. for an electric lighting order to empower it to supply electricity "for all public and private purposes within the district" and for powers to acquire lands for the erection of generating stations and also for powers to provide electrical fittings.

Sandwich.—The T.C. has decided to support the application of the company formed for the purpose of applying for a prov. order for E.L. The company has altered the period in which the Council can purchase the undertaking from 42 years to 21.

Seaton.—At a meeting of U.D.C. on the 6th inst., Messrs. Purves, of Exeter, wrote that they had decided not to proceed with the application for an electric lighting order for Seaton, but if the Council was in favour of an electric lighting scheme, they would be prepared to erect works without an order. It was decided to defer further consideration of the question, to enable the clerk to look into the matter.

Short Heath.—The U.D.C. has appointed a deputation to meet the representatives of the Midland Electric Corporation for Power Distribution with reference to a supply of electricity for the district. The corporation has informed the Council that after three efforts it finds it cannot get sufficient support, and has asked the Council if it can meet the Corporation in any way.

South Africa.—The *South African Union Gazette* contains some particulars of licences granted to the following supply companies under the recent Power Supply Act:—

The Victoria Falls and Transvaal Power Co. is granted a licence within the magisterial areas of Krugersdorp, Germiston, Johannesburg, Boksburg, Pretoria and Heidelberg. It has to supply current required by the Government in any of these districts, but is prohibited from supplying current for lighting purposes except to consumers who also purchase power for motive purposes. In the Johannesburg municipal area the company may not supply for any purpose except by consent of the municipal authority. The limit of supply is 500,000,000 units annually, from whatever source the supply is drawn.

A licence is granted to the Rand Mines Power Supply Co. (which is allied with the Victoria Falls Co.) to supply to 16 specified companies on terms which include a stipulation that the price for air and electricity from October 1st, 1910, to September 30th, 1912 shall be ·56d. per unit, and thereafter ·52d. per unit.

A licence to supply power is also granted to Mr. Howard Pim on conditions which include the following:—For bulk supply, the standard prices to be charged by the licensee shall be as follows—(*a*) To the electro-chemical works (an undertaking intended to be established at Tweenfontein) and to the Tweenfontein Collieries, Ltd., at £7 per annum per KW. of maximum demand; (*b*) To consumers taking quantities exceeding 1,000-KW. years at £7 10s. per annum per KW. of maximum demand; (*c*) To other consumers at £5 12s. 6d. per KW. of maximum demand. The maximum demand is taken over one hour during the calendar year. Per unit consumed the price per KW.-hour varies from 2·5d. during the first two years, and 2·47d. after, for a 10 per cent. load factor, to ·56d. during first two years, and ·52d. after for a 70 per cent. load factor.

According to the *British and South African Export Gazette*, an electric lighting scheme for Parys, Orange Free Sttae, is under consideration, and the Standerton Municipality is about to expend £8,300 on new works, the larger part being for an electrical installation and filtration plant.

Stevenage.—Messrs. Crompton & Co. have informed the U.D.C. that unless the greater part of the capital needed is forthcoming locally, it will be impossible to carry out the electric light undertaking. The Council has decided to take no steps in the matter.

Stone (Staffs.).—Mr. T. B. Sproston has applied for the sanction of the R.D.C. to the use of overhead and underground wires for supplying electricity to Eccleshall. It is proposed to form a syndicate to carry out the scheme. The Council has asked Mr. Sproston to submit a draft of the proposed articles of association of the company, and to state the amount of capital, and how much will be subscribed.

Templemore.—The U.C. has deferred the carrying out of an electric supply scheme, for which Messrs. Wilkins & Burden are consulting engineers, pending the co-operation of the military authorities, who occupy extensive barracks in the town.

Turton (Lancs.).—The U.D.C. has approved of plans, drawings, and specifications for the electric light scheme, and has applied to the B. of T. for consent to the carrying out of the scheme.

Uttoxeter.—The U.D.C. has decided to confer with Mr. Tiddeman, of Stoke-on-Trent, with reference to an E.L. scheme for the town, mention of which has been made in the ELECTRICAL REVIEW.

Wakefield.—With reference to the application of the T.C. for a loan of £7,150 for E.L. purposes, the L.G.B. has requested the Council to submit proposals for liquidating an overdraft of £2,257 14s. 9d. due in respect of the undertaking up to March 31st last. The L.G.B. has been asked to permit the overdraft to be discharged by three equal annual payments to commence during the next financial year.

The T.C. has applied to the B. of T. for consent to supply current to the premises of the Lancashire and Yorkshire Railway at Lupset, which is outside the city boundary.

Walmer.—The U.D.C. on January 5th discussed the application of a local company for a prov. order for E.L., and unanimously decided to support the scheme, it being felt that there are many residences and business premises where electricity would be used. The company proposes a maximum statutory charge of 8d. per unit and a minimum charge of 13s. 4d. per quarter. It is, however, probable that energy will be supplied at 4½d. per unit.

Wells (Somerset).—At the last meeting of the T.C., the town clerk reported the receipt of a letter from Messrs. Purves, in which it was stated that the firm had determined not to prosecute their application for a prov. order this autumn. They had come to this determination largely owing to the difficulties that have been thrown in the way of electric lighting undertakings through the operations of the Electric Lighting Act of 1909. So much is this the case, that they are now promoting three electric light schemes without order, but under agreement with the local authorities. They had in the past carried out four undertakings without Parliamentary powers which are working successfully, and in the event of the Council favouring an electric light scheme for Wells, they are quite prepared to establish works in the town in the event of the Council being willing to enter into an agreement with them. In conclusion, they asked for an interview. No action was taken.

Halifax.—The Tramways and Electricity Committee recommends the acceptance of the tender of the British Thomson-Houston Co. for the supply of the additional plant required, at a total cost of £7,954, including a steam turbine and generator and two 750-KW. rotary converters. The Committee recommended that the cost should be charged to capital account, to be repaid in 10 years instead of 20 years, the time specified in the borrowing powers which were obtained in 1907. The Council, after a long discussion, accepted the tender for the new plant, but decided that the cost should be defrayed out of revenue, and not out of capital. It was suggested that the Committee should be given permission to spread the payment over two or three years, but the Council decided to leave the matter in the hands of the Committee.

West Ham.—In regard to the hire of apparatus (1907 scheme), it has been decided, on the recommendation of the electrical engineer, that incandescent lamp clusters be hired out at an inclusive charge based on the rate of 17s. 6d. per quarter in respect of 700 hours per annum, the excess hours to be at the rate of 1d. per hour, and the registration to be by means of clock meters. This scheme is to be included with the hire of arcs scheme, and depreciated at the same rate.

Winchester.—The report of the Special Committee on the E.L. undertaking, which was received at the special meeting of the T.C. yesterday, states that the Committee has been advised that the plant and works are in good condition, the negotiations resulting in the Corporation agreeing to pay £91,000 for the undertaking as at June 30th last, plus the amount expended on capital account between then and December 31st. The Electric Lighting Co. will from January 1st work the undertaking for the benefit of the Corporation until the taking of it over six months hence; the company is to receive 5 per cent. in the meantime on the amount of the purchase money, the balance of the profits going to the Corporation. The Committee considers the price as a favourable one. The capital last year was £90,596 and the profits £6,882, which equals 7·59 per cent. Since 1905 the profits have been 6·74, 7·25, 7·69 and 7·73 per cent. on a capital, increasing from £84,777 to £89,940 in 1908. The Corporation, in the Bill to be promoted, asks for 45 years in which to repay the loan capital at 4½ per cent. The services of Messrs. Merz & McLellan, consulting engineers, have been secured for a period of five years. The Committee regards the present system of charging for energy as antiquated and unsatisfactory, and hopes to change it to a uniform rate, and the present price as too high, to which matter they will give attention. The present staff will be retained, no decision, however, having been so far arrived at in respect to the resident engineer.

The R.D.C has decided to ask the T.C. to insert in its Bill a clause to ensure that the charges for current in the rural area shall be the same as those in the city, otherwise the Council will oppose the Bill.

TRAMWAY and RAILWAY NOTES.

Belfast.—Should the present increase in the receipts for the Belfast City Tramways continue until the end of the financial year, the undertaking will be able not only to meet the fixed charges but to contribute towards the relief of the rates. The general manager, at the meeting of the Tramways and Electrical Committee, laid on the table the revenue report, which showed the balance on net revenue account for the nine months ended December 31st, after allowing for all fixed charges, to be £23,396. With the Committee's approval, he proposed to run the cars on all routes, generally speaking, 20 minutes later than they are run at present.

Brazil.—Estimates for the conversion of the Carris de Ferro Campineiros Co.'s tramway at Campinas to electrical working are being considered.

A concession is being sought for the construction of a railway from Sao Paulo to Para, on which either steam or electric traction may be adopted.

The Minas section of the Bahia and Minas Railway has been sold by the Government, the purchaser being given power to develop all water powers within 8 km. of the line, with a view to electric traction being adopted.

Brighton.—The T.C. has decided to oppose the Bill for the proposed Brighton-Worthing tramway. The Hove T.C. has decided on similar action. Some of the Brighton Council favoured the proposal, and considered that had the time been such that the full Council could have been present, the voting would have been favourable to the scheme.

Canada.—The Canadian Pacific Railway Co. is to equip with electric light its new sleeping, dining and parlour carriages now being constructed at the company's Angus Works at Montreal. The Stone system will be adopted. Two sets of storage batteries are used, and dining and parlour carriages are being fitted with a small vacuum apparatus worked by an electric motor.

The *Canada Gazette* contains notices of the following applications to the Parliament of Canada:—(1) For an Act incorporating the Imperial Traction Co. with power to construct several lines of railway in Ontario. (2) For an Act incorporating the Canadian Inter-Mountain Railway Co. with power to construct certain railways in Alberta and British Columbia, the railways to be worked by steam, electricity, or other power.—*Board of Trade Journal.*

Continental Notes.—RUSSIA.—According to the *Electric Railway Journal*, plans are at present being considered for the electrification of a portion of the North-Western Railway, in the environs of St. Petersburg, Russia. It is proposed to build a power station for the development of the water-power of the Wolchow, and the scheme comprises the construction of a high-voltage line for the transmission of the electric current for other purposes.

ITALY.—The "Società Anonima dei Tramways Napoletani" has obtained a concession for constructing and working three sections of electric tramway within the boundaries of Torre del Greco; also the Società Anonima les Tramways de Bologna, a concession for the construction and working of various electric tramways in the town of Bologna.

SWITZERLAND.—A decree has been published granting to a preliminary syndicate, represented by Messrs. Aubert, of Cossonay, and Vallière & Simon, of Lausanne, an 80-years' concession for the construction and working of an electric railway (secondary) from Nyon to the French frontier, *viâ* Arzier and St. Cergues. Three years are allowed for the construction of the section from Nyon to St. Cergues.

GERMANY.—The Traffic Committee of the Berlin Municipal Council has just approved the preliminary scheme for the construction of an electric railway between Gesundbrunnen and Rixdorf, which would be eight miles in length and would be mainly built as an elevated route, the remainder being composed of an underground section. It is estimated that the expenditure on construction and equipment would be £4,250,000, and the intended concessionaire company (A.E.G.) would form a separate company to undertake the work. The scheme has yet to be sanctioned by other authorities before it can be proceeded with, although the fate of the rival project for a suspension railway over the same route, as promoted for years past by the Continental Electrical Enterprises Co., of Nuremberg, has apparently to be settled before the A.E.G. plan can be brought to a successful issue.

Dartford.—The R.D.C. has decided to support the scheme of Messrs. Balfour, Beatty & Co., Ltd., for extending the tramways from Horns Cross to Swanscombe. The U.D.C. has also decided to support the application for a prov. order.

Dundee.—On the ground that tramway extension should follow development of a district and not precede it, the T.C. has rejected the proposal to extend the Blackness route to Glamis Road. It was admitted by the Tramways Committee that the extension would not pay at the outset, but it was warranted because of the splendid feuing ground in the neighbourhood.

Edinburgh.—Representatives of the Edinburgh and District (Cable) Tramway Co., Ltd., have had a conference with the Corporation Tramway Committee. The company's representatives undertook to continue their experiments in connection with illuminated signs showing the destination of the cars. The directors also expressed their desire to adopt an improved lifeguard. They explained that the difficulty they have had to face is still present, viz., the cable gripper, which prevents the adoption of the "cow-catcher" guard. It was remitted to the burgh engineer and the tramway engineer to try to devise an improvement on the type of guard which is used on the cars.

Elland.—At the District Council meeting on the 5th inst. it was announced that the General Purposes Committee had sent a deputation to the Halifax Tramways Committee, and offered that if the Halifax Corporation would extend its service to Elland, the District Council would give a subsidy of a rate of ¼d. in the £ (equal to £100) per annum for five years. The Halifax Tramway Committee refused to accept the offer, and the alternative was that the Tramways Committee could not accept less than the product of 1d. in the £. Mr. F. Pearson moved the adoption of the minutes of the General Purposes Committee of the Elland Council, rejecting this. He said the demand of Halifax was equal to £2,000, and they had been very much surprised at the action of the Halifax authority. Mr. F. Holroyd said Elland would have been one of the most paying routes. The resolution was carried unanimously.

Glasgow.—Some time ago, as then reported in the REVIEW, the Tramways Committee of the T.C. refused to entertain an application by motormen and conductors in the employment of the department for an eight-hour day. In this connection a mass meeting of the men was held in the city on Sunday, 9th inst., under the auspices of the Municipal Employés' Association, at which officials of that body gave addresses.

Gosport.—The Crofton P.C. has approved of the proposal to extend the Gosport and Fareham electric tramways to Lee-on-the-Solent.

Halesowen.—The Halesowen Light Railway Co. has applied for powers to construct a line between Balden Road, Quinton, and Bearwood, and an inquiry into this application is to be held next month by the Light Railway Commissioners. If the new line is sanctioned it will be an important development, for it will tap an entirely new district and open up tramway communication between Birmingham and Stourbridge through Halesowen. It is thought that an agreement will be entered into with the Birmingham C.C., or other local authority, for the construction and working of the

line. The history of previous proposals has made it clear that uncompromising opposition would be offered to any scheme which might interfere with the free development of the public systems of tramways from Birmingham and neighbouring towns.

Liverpool.—The annual returns respecting the Corporation tramways, ending December 31st, 1910, constitute a record in regard to receipts and number of passengers carried. The figures are as follows:—Mileage, 12,235,408, an advance of 283,035 over 1909, and of 3,609 over the previous record year of 1907; passengers, 25,507,283, an increase of 3,974,343 over 1909, and of 1,464,044 over 1907; receipts, £581,215, representing increases over 1909 and 1907 of £20,988 and £9,285 respectively. In the electric supply department the units used for lighting, tramways and power purposes, from January 1st to November 30th, totalled 32,150,416, as compared with 31,542,437 in 1909.

Macclesfield.—The Railless Electric Traction Co., which is applying for powers to run cars in the town, has informed the T.C. that it intends erecting a generating station in Byrons Lane. The Council has decided to obtain the draft Bill of the company before deciding what action shall be taken in the matter.

Manchester.—At the meeting of the Tramways Committee on Tuesday the question of an eight-hour day for tramway men was discussed. It was decided to reply to Mr. Jackson, the general secretary of the Tramway and Vehicle Workers, to the effect that the wages of the men have been considerably increased, and if all the concessions are taken into account, the increase amounts to 45 per cent. in the case of drivers, and 65 per cent. in the case of conductors. The Committee pointed out that of 85 municipal undertakings 63 work their men 60 hours a week or more, and only 15 (including Manchester) work them 54 hours per week, or nine hours per day. None of them have adopted an eight-hour day. The Committee does not see why Manchester should be singled out as the city where an eight-hour day should be adopted, particularly when London, Liverpool, Leeds, Bradford and Nottingham are working their tramway men 10 hours per day, or 60 hours per week. The Committee observes that some of the cities have granted concessions which have brought their men's wages a little higher than those paid in Manchester, and the Committee is now proposing (subject to the approval of the City Council) to make certain alterations partly in the direction of the granting of bonuses for satisfactory services, which it is hoped will be appreciated by the staff. This reply is signed by Mr. McElroy, the general manager.

Marsden (near Huddersfield).—The Huddersfield Corporation has intimated to the U.D.C. that when the former applies for Parliamentary powers, provision will be made for extending the tramways from Slaithwaite to Marsden.

Nelson.—The question of the consolidation of the tramway system in the Nelson district, and the establishment of a through running service between Padiham and Colne, was discussed by a sub-committee of representatives of the Nelson Electricity and Tramways Committee and Mr. J. T. Landless, acting for the Colne and Trawden Light Railway Co. It was decided that before negotiating further, the company be asked to arrange for through running between the Nelson centre and Colne for six months, and that, subject to this arrangement, application be made to the B. of T. for consent to the proposed working agreement.

Newcastle-on-Tyne.—The report on the first six months of the current financial year of the Corporation tramways which ended on September 30th, just issued, shows an income from all sources of £104,461, and the working expenditure £55,939. This leaves a balance of £48,521 to be carried to the net revenue account. To be added to this is bank interest and interest on investments £1,554, which makes a total in the net revenue account of £50,075. From this amount, however, there has to be paid interest on the capital borrowed, special rents, and income-tax, which amounts to £18,178, leaving a balance of £31,897 to be carried to the appropriation account. Out of this latter account was paid the contribution to the sinking fund and to the Corporation on unexpired debts left by the horse tramways £19,501, which leaves a net balance of £12,000 profit. This is carried to the reserve and renewals account. Thus in the six months of 1910 the profits are within £3,000 of the total profit made during the year 1909-10, while for the whole of the year 1908-9 the total profit was roundly £7,000.

Oldham.—On the 6th inst. a serious accident occurred on the Oldham, Ashton and Hyde Tramways at Bardsley Brow. A car was proceeding down the hill, which is very steep, when the wheels began to skid; the driver being unable to stop the car, it collided with another car coming in the opposite direction, the track at this part being single. Both cars were badly damaged, and the driver of the runaway car was seriously injured; the passengers escaped with a severe shaking.

Rochdale.—Some time ago the Tramways Committee renewed its appeal to the Gas and Electricity Committee for some concession in the price paid for energy for traction, and the Electricity Committee has now agreed to reduce the price slightly; it is estimated that the concession will mean a loss to the electricity department of about £1,000 a year. In the 12 months ended on March 31st last, the tramways department paid £9,697 for energy.

Sheffield.—The City Council has decided to devote £33,877, balance of tramways profits, to wiping off the accumulated deficit of £26,887 on markets account, and another big deficit on surplus land transactions.

South Wales.—There is a project on foot for the construction of an electric tramway to join the mining districts in the Ogmore and Garw Valleys in South Wales, and the various Councils within the area have been asked to send representatives to a Joint Committee to consider the question of ways and means.

West Ham.—The Tramways Committee has considered a suggestion that the Prince Regent Lane line should now be constructed, and has decided, subject to the usual sanction, in favour of this, including a double line at the end of Greengate Street, in place of the existing single line. The estimate is £18,113.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Federal P.M.G. proposes to convert one of the country exchanges from the manual to the automatic system, as an experiment.

Australasia.—Direct wireless communication between New Zealand and Australia was established last week by the Dominion Postal authorities.

Glasgow.—Rapid progress is being made with the preparations for the amalgamation on January 1st, 1912, of the Post Office and the National Telephone Co.'s systems in Glasgow, a start having been made by the transference of 1,600 National subscribers from that company's Royal exchange to the Post Office Central exchange in Waterloo Street. This process will gradually be extended, and meantime new P.O. exchanges are approaching completion in Queen's Park, Hope Street, Bell Street and Rutherglen, to which contingents of National subscribers will, in time, be connected. The introduction of intercommunication between the two systems, inaugurated last week, is working satisfactorily. The new arrangement is that a subscriber on the National system can call up a Post Office subscriber within a given group of exchanges on payment of 1d. fee, and *vice versâ*, while calls to exchanges outside the group cost 2d. each. Small users find that this arrangement is cheaper than paying rents to both companies.

Lepel Patents.—The German Imperial Patent Office has granted letters patent for the "singing-spark" system of wireless telegraphy invented by Herr von Lepel, who applied for patent rights three years ago. The system has been imitated by the German wireless companies, who refused to purchase the invention; the latter was bought by a British syndicate, which owns the master patents in all the leading countries.

Telephone Rates.—Mr. Herbert Shaw, Hon. Sec. of the Telephone Committee of the Association of Chambers of Commerce, has issued a circular letter to Town Councils, &c., stating that he has been desired by his Committee to point out that it is feared that it is the intention of the Postmaster-General, on taking over the National Telephone Co.'s system at the end of next year, to withdraw the unlimited rate, and to place all subscribers on the measured rate, and asking the Council to support an application for a Parliamentary inquiry into the whole question of the future control and charges of the telephone system.

The Telephone in Japan.—The twentieth anniversary of the first establishment of the telephone in Japan was celebrated on the 16th ult., when Mr. Nakakoji, the Japanese Vice-Minister of Communications, made some interesting statements with regard to the development of the telephone in that country. In 1890, the year of commencement, there were only 16 stations and 2 exchanges throughout the whole country. Ten years later these numbers had grown to 74 and 25 respectively, and there had been added 4 automatic telephones. The figures for 1910 are 1,568 stations, 708 exchanges and 484 automatic telephones. As to the increase in the number of subscribers, this may be judged from the fact that in 1890 there were only 343; in 1900, 11,668, and in 1910, 126,720. So far a sum of £2,300,000 has been expended by the Japanese Government on its telephone system, but in view of the fact that there are at present over 42,000 people waiting to have the telephone installed in their premises, it is proposed to increase the 1911 appropriation from £450,000 to £650,000.

The Teletypograph.—It is announced from Munich that success has attended the recent journey of Monsignor Cerebotani from that city to Paris, for the purpose of demonstrating his latest invention before representatives of the French Government. The French Minister of Posts and Telegraphs is said to have informed the inventor that he will submit a proposal to the Chamber for the acquisition of the teletypographic invention which, by the use of a kind of typewriter, permits of messages being telegraphed to a person, and being immediately written down. The employment of the invention is to take place at first only on lines of subordinate importance, where the postal officials are unable to deal with the Morse code with sufficient dexterity, and if it answers the purpose the apparatus is to be introduced on a large scale. A Franco-American syndicate is in negotiation with the inventor for the industrial utilisation of the system.

Wireless Telegraphy.—The interest manifested recently on the Berlin Stock Exchange in the shares of the Lorenz Telephone and Telegraph Works Co. is attributed in part to the statement that the company has succeeded in bringing into use a new invention in

relation to wireless telegraphy. As a Berlin newspaper learns from an informed quarter, the question refers to the practical utilisation of patents which were granted a few years ago. Hitherto the company has been working on these patents in conjunction with the inventor, and success has now attended the construction of a high-frequency machine, which, it is said, renders possible transmission by wireless telegraphy over the greatest distances—as, for instance, into transmarine countries. The use of these machines naturally requires considerable expenditure for transmission and receiving stations, but the financial situation of the company is depicted as such that the requisitioning of fresh funds on a large scale for the utilisation of the invention will not be necessary.

The Italian Government, which was the first to pass a law compelling shipowners to install wireless telegraphy on emigrant vessels, has confirmed the law, and supplemented it by an important decree, which takes effect from January 1st, 1911. In accordance with this decree all ships—Italian or foreign—carrying emigrants between Italian and foreign ports must be equipped with wireless telegraph apparatus on the Marconi system. The decree will affect a number of British ships which carry emigrants from the Mediterranean and touch at Italian ports.

The German Post Office has brought pressure to bear upon the leading shipping companies, with a view to the substitution of the Telefunken system for the Marconi system on German ships, on the ground that this is the only way to ensure satisfactory communication between the stations of the German Post Office and those on German liners.

Wireless Telegraphy and Railway Trains.—According to the *Mechanical Engineer*, trials have recently been made in Toronto with a system invented by Mr. F. W. Prentice, of the Canadian Pacific Railway, for the application of wireless telegraphy to the operation of railway trains. The experiments were made with two engines and were conducted on two miles of double track, consisting of six blocks or sections each about 3,000 ft. long, with two starting blocks 2,000 ft. and 3,000 ft. in length. Hertzian wave generators were situated at the end of each block, controlled by alternating-current track circuits and relays. The Hertzian wave wire for each block was contained in a wooden boxing, lying midway between the rails and filled with pitch. On entering a block the train stopped the wave in the block behind, giving the danger signal to any train entering that block.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—January 17th. 750 tons of steam coal, for the U.D.C. electricity works. See "Official Notices" December 30th.

Annfield Plain (co. Durham).—January 23rd. Electric installation at the Electric Theatre, for R. J. W. Bloom; L. H. Armour, 16, West Street, Gateshead.

Australia.—February 1st. Testing equipment, for the P.M.G.'s Department in New South Wales. See "Official Notices" December 9th.

February 7th.—250 indicators, for the P.M.G.'s Department in Victoria. See "Official Notices" December 16th.

March 7th.—Eleven sections of a branching multiple magneto lamp-signalling switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" December 16th.

March 14th.—Installation of wireless telegraphy at Thursday Island and Papua, for the P.M.G. of Australia. See "Official Notices" December 23rd.

April 18th.—One common-battery switchboard, for the P.M.G.'s Department in Western Australia. See "Official Notices" Dec. 23rd.

January 30th.—State Railways. Two electrically-worked elevators, for the tramway repair-shops at Randwick.

February 21st.—29 miles of telegraph cable, for P.M.G.'s Department, Victoria. See "Official Notices" January 6th.

February 28th.—One petrol-driven portable winch, for P.M.G.'s Department, Victoria. See "Official Notices" January 6th.

February 28th.—Motor-generator and accumulators, for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

March 7th.—10,000 telephone protectors, for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

Barnes.—February 13th. Straight-tube water-tube boiler fitted for machine stoking, 600-750-KW. steam dynamo, surface condenser, motor-driven air and circulating pumps, river work and piping, for the U.D.C. See "Official Notices" to-day.

Belgium.—February 8th. The Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), are inviting tenders for installations of electric lighting at the railway depôts at Grimberghen and Dilbeek.

Birmingham.—January 30th. Stores for the Corporation Tramways Department. See "Official Notices" Dec 30th.

Bacup.—February 5th. High and low-tension cables and ducts, transformers and meters, for the Corporation. See "Official Notices" to-day.

Bootle.—January 18th. Two turbine pumps, electrically driven, for the Raleigh Street pumping station, for the T.C.; Borough Electrical Engineer, electric light station, Pine Grove.

Bournemouth.—February 23rd. Welsh smokeless coal (washed peas), for the tramway generating station for a year, for the T.C.; C. W. Hill, general manager, Lansdowne (returnable deposit of £1 1s.).

Cape Town.—March 1st. Tenders are invited for the installation of a system of ventilation, heating and cooling in the new Law Courts. See this column in our issue of December 30th.

Cardiff.—Electric light wiring of the Kitchener Road Council schools, for the Corporation. Specification, &c., from Mr. Arthur Ellis, the city electrical engineer.

Croydon.—January 26th. Five single-truck double-deck cars, for the Corporation tramways. See "Official Notices" to-day.

Denmark.—January 16th. One 4,000-KW. turbo-generator, with condensing plant, for the municipality of Copenhagen. See "Official Notices" December 23rd.

India.—February 6th. Combined H.T. and L.T. switchboards for new sub-stations, and switchboards for the Cossipore station, for the Calcutta Electric Supply Co., Ltd. See "Official Notices" to-day.

London.—BATTERSEA.—The Electricity Committee is to issue advertisements inviting tenders for coal, oils, stores, carbons, meters, lamps, cables, &c.

ISLINGTON.—February 3rd. Electrical and engineers' stores, for the B.C. See "Official Notices" to-day.

Plymouth.—January 25th. Stores for a year, for the Corporation Electricity and Street Lighting Departments. See "Official Notices" January 6th.

Portuguese West Africa.—March 25th. The municipal authorities of San Thomé, Portuguese West Africa, are inviting tenders for the concession for the establishment of a central generating station for the supply of electrical energy for lighting and power purposes in the town.

Salford.—January 16th. Steam-driven air-lift pumping plant, for the Corporation electricity works. See "Official Notices" December 16th.

Shanghai.—January 18th. Main H.T. switchboard and auxiliary switchgear for generating station; static transformers and high and low-tension switchgear for sub-station, for the Municipal Council. See "Official Notices" December 30th.

January 26th.—6,600-volt three-core cable, stoneware troughing, bitumen, &c., for the Municipal Council. See "Official Notices" to-day.

Sheffield.—January 21st. Stores, for the Corporation Tramways Department. See "Official Notices" January 6th.

Spain.—January 26th. The local office of the Spanish Ministerio de Fomento, at Bilbao, are inviting tenders for the concession for the construction and working of an electric tramway in the city between the Plazuelo de Santiago and the Plazuelo San Nicolas.

The municipal authorities of Mondragon (province of Guipuzcoa) have just invited tenders for the concession for the public and private electric lighting of the town during a period of five years. Similar tenders have also been invited by the municipal authorities of the town of Pueblo Nuevo del Terrible (Cordoba), the period of the concession in this case being six years.

Sweden.—March 31st. The Wasserfalldirektion in Stockholm is inviting tenders for the supply of four turbines of 12,500 H.P. capacity.

Thurstonland (Yorks.).—The U.D.C. has decided to invite tenders for repairing the electric light wires, &c., at Storthes Hall Lane.

Taunton.—2,500-volt single-pole switches and fuses, for the Corporation. See "Official Notices" December 23rd.

Turkey.—March 14th and 15th. The Ministry of Public Works is prepared to receive tenders for the following works:—(1) Construction of a generating station in the Vilayet of Constantinople; (2) construction of tramways and a generating station in the Sandjak of Adrianople. See this column last week.

CLOSED.

Australia.—The Victoria State Railways Department has accepted the tender of the B.I. Co. for rubber-covered 7-strand copper wire, at £17 5s. per mile.—*Australian Mining Standard.*

Bedford.—The contract for wiring the new refuse destructor for the B.C. has been placed with Messrs. W. S. Wilton and Co., Bedford.

Belgium.—Again a British firm has been successful in submitting the lowest tender for one of the Belgian Posts and Telegraphs Department's contracts—namely, for the supply of two armoured telegraph cables. Six German and two British concerns competed for the order, the lowest offer being that of W. T. Henley's Telegraph Works Co., Ltd., London.

Bournemouth.—The T.C. has accepted the tender of Messrs. Clough, Smith & Co., Ltd., for the construction of the overhead system of the tramways from the Lansdowne to St. Michael's Church, at £1,726.

Canterbury.—The T.C. has appointed Mr. L. A. Wells, of Canterbury, to carry out electrical work during the next half-year.

Glasgow.—The T.C.'s Sub-committee on Tramways Works and Stores recommends acceptance of the following offers:—

Crossovers for special track work.—Hadfield's Steel Foundry Co, Ltd.
V. I. R. cables.—W. T. Glover & Co., Ltd.
Lead-covered power cables.—National Conduit and Cable Co., Ltd.
Double lead-sheathed telephone and test cable.—The British Insulated and Helsby Cables, Ltd.

Halifax.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for plant for the electricity works, including a steam turbine and generator, and two 750-KW. rotary converters, at a total cost of £7,954.

Leicester.—The Corporation Tramways Department has ordered four high-duty smokeless and gritless coking stokers and self-cleaning compressed-air furnaces for 8 ft. 6 in. Lancashire boilers, from Messrs. Ed. Bennis & Co., Ltd. This is a repeat order.

London.—STEPNEY.—The B.C. Electricity Committee received the following tenders for a motor-driven air-compressor for Limehouse station:—

Reavell & Co., Ltd.	(recommended)	£215
F. Pearn & Co., Ltd.		325
Lacy-Hulbert & Co., Ltd.		334
Alley & MacLellan, Ltd.		350

Siebe, Gorman & Co., Ltd., were unable, through pressure of Government work, to tender.

L.C.C.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained the contract for metal-filament lamps for the L.C.C. Tramway and Stores Department for the ensuing 12 months.

The L.C.C. Asylums Board has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for the supply of metal-filament lamps.

New Zealand.—The *Australian Mining Standard* states that the contract for the construction of the power station, sub-stations, and switchboards for the hydro-electric supply scheme for the Waihi Mine, New Zealand, known as the Hora Hora scheme, has been let to Messrs. Siemens Bros., of London. The power has to be transmitted over a distance of 47 miles.

Sheffield.—The City Council has accepted the following tenders:—

British Electric Transformer Co., Ltd.—Transformers and choking-coils, £872; six sets of transformers, comprising main and auxiliary transformers and series gear, £211 per set.
Wellerman Bros.—Extensions to Neepsend power house, £14,700.

Stockport.—The T.C. has accepted the tender of Messrs. Edgar Allen & Co., Ltd., of Sheffield, for tramway points and crossings, at £117.

Torquay.—The T.C. has renewed, for 12 months, its contract with Messrs. Ferranti, Ltd., for the supply of meters, the company agreeing to reduce the price of the small meters by 1s. 6d. each, and the large meters by 3s. each.

Walsall.—The Electricity Committee has accepted the tender of Messrs. Bumstead & Chandler, Ltd., for a new fan in connection with the forced draught for the new Babcock boiler (£137); and also the tender of Messrs. E. Bennis & Co., Ltd., for the coal elevator for the boiler (£101).

Watford.—The U.D.C. has accepted the tender of Siemens Bros., Ltd., for the annual supply of meters. Their tender was the lowest received.

West Ham.—The T.C. has renewed, for a period of 12 months, the existing contract of the British Westinghouse Co., Ltd., for the supply of transformers.

FORTHCOMING EVENTS.

Westminster Technical Institute (L.C.C.). Vincent Square, S.W.—Friday, January 13th. At 7.30 p.m. First of a course of six weekly lectures on "Illumination," by Mr. J. S. Dow.

Association of Engineers-in-Charge.—Saturday, January 14th. At 3 p.m. Visit to the works of the Metropolitan Electric Supply Co., Ltd., Willesden Junction, N.W.

Manchester Association of Engineers.—Saturday, January 14th. Paper on "Condensing Plant," by Mr. W. A. Dexter.

Junior Institution of Engineers.—Monday, January 16th. At 7.30 p.m. At Caxton Hall, Westminster. Fifth Lecture on "The Law Relating to Engineering," by Mr. L. W. J. Costello.
Saturday, January 21st. At 10 a.m. Visit to the Royal Arsenal, Woolwich.

Illuminating Engineering Society.—Monday, January 16th. At 8 p.m. At the Royal Society of Arts. Discussion on "Library Lighting," to be opened by Messrs. J. Duff Brown and S. L. Just.

Institution of Electrical Engineers (Manchester Section).—Tuesday, January 17th. At 7.30 p.m. At the University, Manchester. Paper on "Electric Heating as applied to Cooking Apparatus," by Mr. H. Gray.

Association of Mining Electrical Engineers.—Tuesday, January 17th. At 8 p.m. At the Junior Institution of Engineers, 39, Victoria Street, S.W. Discussion on paper by Mr. E. K. Scott, on "Electricity in New South Wales Collieries."

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, January 18th, At 7 p.m. for 7.30. At the Grand Hotel, Birmingham. Annual dinner.

Institution of Electrical Engineers (London Students).—Wednesday, January 18th. At 7.30 p.m. At the Institution Building, Embankment, W.C. Paper on "Wireless Telegraphy, with Special Reference to Short Spark Methods," by Mr. P. R. Coursey.

Rugby Engineering Society.—Thursday, January 19th. At 8 p.m. At Benn Buildings, Rugby. Paper on "Electric Power in Collieries," by Mr. J. Miller.

Institution of Mechanical Engineers.—Friday, January 20th. At 8 p.m. At the Institution House, Storey's Gate, S.W. Paper on "Modern Electrical Dock Equipment, with Special Reference to Electrically-operated Coal-Hoists," by Messrs. W. Dixon and G. H. Baxter.

Royal Institution.—Friday, January 20th. At 9 p.m. Discourse on "Chemical and Physical Changes at Low Temperatures," by Prof. Sir J. Dewar.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

THE following orders are issued:—

Commanding Officer—COL. H. M. LEAF.

Monday, January 16th.—"A" Company. Technical drill, 7 to 10 p.m.
Tuesday, January 17th.—"B" Company. Technical drill, 7 to 10 p.m.
Thursday, January 19th.—"C" Company. Technical drill, 7 to 10 p.m.
Friday, January 20th.—"D" Company. Technical drill, 7 to 10 p.m.
(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant.

NOTES.

Electrical Engineers' Ball, 1911.—The annual ball will be held in the magnificent new ball rooms called the Connaught Rooms of the Freemasons' Hall, Great Queen Street, London, on February 10th. Mr. Pritchett's band has again been engaged, and this augurs well for the quality of the dance music. The gentlemen forming the Committee for the year are as follows:—

Alabaster, H.
Baldwin, O. H.
Belfield, R.
Bowden, J. H.
Browett, T.
Belshaw, T.
Cramb, A. C.
Callender, Jas.
Dobson, Sydney
Davenport, F. R.
Erskine, R. S.
Ferranti, S. Z. de
Fox, E. J.
Gatehouse, T. E.
Gavey, Sir J.
Geipel, W.
Gray, Jas.
Gray, R. Kaye
Hadley, A. E.
Hammond, R.
Harrison, H. E.
Hirst, H.
Highfield, J. S.
Kingsbury, J. E.
Lacey, E. M.
Leigh, F. A. C. L.
Lane, W. E.
Leaf, H. M.
Madgen, W. L.
Matthews, W. Lee
Mordey, W. M.
McKay, H. T. S.
McMahon, P. V.
Murray, Lee
Nalder, F. H.
O'Meara, Major W. A.
Otley, T. G.
Partridge, G. W.
Pearson, Hugh A.
Raworth, J. S.
Roberts, Martin F.
Robinson, L. L.
Rutherford, W.
Rowell, G. F.
Sharp, Sydney
Shepherd, Joseph
Siemens, Alex.
Sillar, A. M.
Scholey, H.
Stretche, T. E. P.
Sutton, G.
Sparks, C. P.
Taite, C. D.
Taylor, J.
Wallis-Jones, R. J.
Wordingham, C. H.

Inquiry.—Makers of "Mercury" flashers" are asked for.

Port Elizabeth Electricity Supply.—The following letter came to hand too late for inclusion in our "Correspondence" columns:—

"In your issue of January 6th you give an excellent description of the Port Elizabeth Electricity Station, and you conclude this description with the information that Messrs. Robert Hammond and Son, of London, are the consulting engineers, and the electrical engineer is Mr. H. J. Holder.

"I think it is only fair to point out, however, that the plans of this electricity supply station were drawn up by me, and I had the carrying out of the work exactly as described in your article. Messrs. Robert Hammond & Son were consulted with a view to passing my plans, as against plans put forward by themselves. The work of inspecting the machinery before leaving England was undertaken by Mr. Harold Hastings.

"The very low works cost are due to the fact that my plans were drawn up with a view to this result, as the capital involved in the undertaking was obtained fairly cheaply, and labour, coal, stores, &c., are expensive in South Africa.

"R. PAPE.

"London, *January 10th*, 1911."

Parliamentary.—MEMORIALS AGAINST PRIVATE BILLS.—Monday was the first day for the depositing of memorials against Private Bills, alleging non-compliance with Standing Orders. Among those so objected to were the Brighton District Tramways, the memorials being made by the Brighton, Hove and Worthing Corporations; the London County Council Tramways and Improvements Bill, by the Willesden Urban District Council, and the Borough Councils of Chelsea, Hampstead and St. Marylebone; the Nottingham and Derbyshire District Tramways, by the County Councils of Derby and Nottingham; the Western Valleys (Monmouthshire) Railless Electric Traction, by the Abertillery and Nanty-glo-Blains Urban District Councils; and the Rotherham, Maltby and District Electric Railless Traction, by the Rotherham Corporation.

Institution and Lecture Notes.—MINING INSTITUTE OF SCOTLAND.—At a meeting of the Mining Institute of Scotland on December 21st, the discussion was resumed on the paper jointly contributed by Mr. Robert Crawford and Harold Moores on "Power Production at Collieries with special reference to Gas Power and Electrical Centralisation." Mr. Frank Anslow (Glasgow) pointed out that one of the most important suggestions which the authors embodied in their paper was that for the establishment of a generating station, with ammonia recovery plant, to supply a group of collieries. In order, however, to procure a load sufficient to make such a proposition commercially successful, and to eliminate steam plant at individual pits, it would be necessary not only to establish a working agreement between the various owners, but to replace all steam engines, including winding engines, by electric motors, and the conversion of all winding plants to electric power would involve a very heavy capital outlay. In many cases considerable economy was afforded by electrical winding, both as regards saving in power and increased output, but in others the margin between steam and electric winding was very narrow.

NOTTINGHAM ENGINEERING SOCIETY.—At the opening meeting of the twenty-eighth session on Saturday, a lecture was delivered by Mr. J. W. Wing on a journey to the East. The audience numbered nearly 200 ladies and gentlemen, including several members of the City Council and representatives of the Chamber of Commerce, the Architects' Society, the University College, the engineering department of the Post Office, the Great Northern Railway and the Thorston Society. The members and guests were received and welcomed by the President, Mr. F. W. Davis, M.I.M.E., city water engineer, and Mrs. Davis.

INSTITUTION OF ELECTRICAL ENGINEERS (GLASGOW LOCAL SECTION).—On Tuesday Mr. W. W. Lackie read a paper on "Notes on Every-day Uses of Electricity."

ELECTRICAL STANDARDISING, TESTING AND TRAINING INSTITUTION.—Dr. W. H. Eccles began a course of lectures on "Wireless Telegraphy and Telephony," and Mr. A. B. Clark, B.Sc., A.M.I.E.E., of Lot's Road generating station, gave the first of his demonstrations on "Fuel Testing," to the senior students of Faraday House this week. In connection with the commercial training of the students at Faraday House, so successfully inaugurated by a lecture on "Depreciation," by Major O'Meara, C.M.G., engineer-in-chief to the Post Office, Mr. A. Schneider, M.A., M.I.E.E., the managing director of Messrs. Evershed & Vignoles, Ltd., has given a lecture on "Works Management," and Mr. Robert Hammond, M.Inst.C.E., will shortly deliver a series of lectures on "Electricity Undertakings."

INSTITUTE OF METALS.—A large increase has recently taken place in the membership of the Institute, which now totals over 550 members. Additional honorary members have been appointed in the persons of Dr. R. T. Glazebrook and Sir Andrew Noble, whilst Sir William H. White has been elected the first Fellow of the Institute. The annual general meeting of the Institute, to be held this month, promises to be an exceptionally interesting affair.

On January 17th members will visit, by the courtesy of the Thames Ironworks, Shipbuilding and Engineering Co., Ltd., the yard in which H.M.S. *Thunderer* is being built, and will pay a visit to the new warship. The second annual dinner will be held the same evening.

On Jan. 18th the following papers will be read and discussed: "A New Critical Point in Copper-Zinc Alloys: Its Interpretation and Influence on their Properties," by Prof. H. C. H. Carpenter, with an appendix on "The Nature of Solid Solutions," by Mr. C. A. Edwards; "Some Practical Experience with Corrosion of Metals," by Engineer Rear-Admiral J. T. Corner; "Some Tests on White Anti-Friction-Bearing Metals," by Mr. H. J. Humphries and Prof. C. A. Smith; "The Adhesion of Electro-Deposited Silver, in Relation to the Nature of the German Silver Basis Metal," by Prof. A. McWilliam and Mr. W. R. Barclay. There will also be presented the "Preliminary Report to the Corrosion Committee," by Mr. G. D. Bengough. This report will be of a most important character, dealing with "The Present State of Our Knowledge of the Corrosion of Non-Ferrous Metals and Alloys, with Suggestions for a Research into the Causes of the Corrosion of Brass Condenser Tubes by Sea-Water."

Particulars and visitors' tickets for next week's meeting can be obtained from Mr. G. Shaw Scott, M.Sc., the Secretary of the Institute of Metals, Caxton House, Westminster, S.W.

Legal.—MARCONI PATENT CASE.—The hearing of this case, which was adjourned over the Christmas vacation, was resumed on Wednesday afternoon.

LONDON ELECTRIC SUPPLY CORPORATION *v.* WESTMINSTER ELECTRIC SUPPLY CORPORATION, LTD.—Plaintiffs' counsel said that they were moving to restrain the defendant corporation in effect from enticing away their customers. Mr. Justice Joyce ordered the motion to stand over until to-day, plaintiffs to file their evidence in the meantime.

BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., *v.* UNDERGROUND ELECTRIC RAILWAYS CO. OF LONDON, LTD.—This special case, in the matter of a pending arbitration, came before the Divisional Court on Wednesday. The hearing was in progress when the Court adjourned. Our report will be published next week. The case relates to turbines and turbo-alternators, ordered in 1902.

Appointments Vacant.—Assistant borough electrical engineer for Stockton-on-Tees (£120); canvasser for the consumers' department of the Harrow Electric Light and Power Co., Ltd. (30s.); switchboard attendant for the Northampton Corporation (25s.) See our advertisement pages in this issue.

University College.—In 1909 an appeal was made for £70,000 for the addition of new chemical laboratories to University College, London; the site will cost £25,000, of which only £14,000 has been raised, and the remaining £11,000 must be secured before the end of this month, as the option expires on January 31st. The new laboratories are urgently needed.

The Scottish Exhibition.—The *Times* states that the Duke of Connaught has fixed May 3rd for the opening of this Exhibition.

American Exports of Electrical Machinery.—Exports of electrical machinery from the United States had a value of $600,000 during November, as compared with $500,000 for November of 1909. The value of electrical machinery exported during the 11 months ending with November, 1910, was $6,900,000, while the figure for the same period of 1909 was $5,500,000.

Our Chicago namesake has been chiding electrical firms in the U.S.A. for their apathy in regard to the South American market. They are charged with "neglecting their opportunities," and failing to make "proper efforts," trusting their interests to "foreign agents" only.

Will.—The will of the late Mr. Gustav Byng, whose death at the age of 55 years was announced in these pages some weeks ago, has been proved. The estate has been valued at £100,700, with net personalty £99,883. £1,000 was left for charitable purposes at the executors' discretion. Most of the remainder goes to members of the deceased gentleman's family.

Steel Trolley Wire.—The Brooklyn Rapid Transit Co. has experimented during the last two years with six miles of 0000 (B. & S.) grooved steel wire, and it is not surprising to see no reference to an intention to extend its use, although the first cost is half that of copper, while longer life "may be confidently expected." The list of disadvantages is formidable: Scrap value, practically nothing; heavier feeders required, because of the greater drop; higher erection costs, on account of its stiffness; the wire more quickly fused on short-circuit; and hanger insulators rapidly deteriorated from rust thrown into them by the trolley wheel. We should have anticipated nothing more favourable.

This information is gleaned from the November issue of the *Electric Railway Journal*, in which appears the sixth and concluding article of an interesting series upon the overhead and track design and maintenance of the Brooklyn lines.

The Electro-Turbo-Loco.—Reference was made in the columns of the REVIEW some months ago to the experiments which had been made at the Hyde Park Locomotive Works, Glasgow, with the Reid Ramsey new turbo-electric locomotive. It is now proposed to make further devolopments. A second locomotive engine is under construction, in the design of which several deviations have been made in the direction of cheapening and simplifying the process of building.

English Telephone Engineers in Belgium.—The case of the four engineers who were accused of abstracting confidential documents belonging to the Bell Telephone Co., and acquitted in 1909, came before the Court of Appeal at Antwerp on Friday last. The Court confirmed the acquittal pronounced by the Lower Court.

A Big Indian Scheme.—According to a note in yesterday's *Daily Mail*, Messrs. Pauling & Co., Ltd., Westminster, have been given the contract for the construction of a dam in connection with the Bombay hydro-electric scheme, the total cost of which is estimated to be about a million and a half sterling.

Metal Trades Ball.—The annual ball of the Royal Metal Trades Pension Society will be held at the Portman Rooms on February 2nd. The proceeds are devoted, not to pensions, but to emergency donations, and to the temporary relief of those who are not eligible for the Society's permanent benefits, and the President, Mr. F. A. B. Lord (Messrs. W. F. Dennis & Co.), makes an urgent appeal for support, even from those who cannot attend. It unfortunately falls on the night of the I.E.E. postponed dinner, but we understand that many are going on to the ball after the dinner.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—At the meeting of the Poplar B.C. on January 5th, the Finance Committee recommended a scheme for grading the officers of the Council and their salaries. As far as the electricity department is concerned, the officers affected are as follows:—W. INNES, assistant engineer, (*a*) present salary, £252 10s., (*b*) increment under new scale, £12 10s., (*c*) maximum, £300; E. R. INGRAM, mains superintendent, (*a*) £172 10s., (*b*) £12 10s., (*c*) £200; V. H. CRUICKSHANK, station superintendent, (*a*) £185 10s., (*b*) £12 10s., (*c*) £200; F. TAIT, managerial clerical assistant, (*a*) £175, (*b*) £12 10s., (*c*) £200; E. W. BAILEY, prime cost clerk, (*a*) £130, (*b*) £10, (*c*) £150; E. MEECH, inspector, &c., (*a*) £140, (*b*) £10, (*c*) £150; W. A. ELLICTT, correspondence clerk, (*a*) £88, (*b*) £10, (*c*) £120; F. JENNINGS, junior prime cost clerk, (*a*) £58 10s., (*b*) £6 10s., (*c*) £78.

The Worcester C.C. has increased the salary of MR. R. SMITH, chief assistant engineer at the electricity works, from £140 to £155 per annum.

MR. JOHN MCMILLAN, electrical engineer to the Falkirk Corporation, has intimated his resignation of the post, the reason being that he is going abroad. Mr. McMillan went to Falkirk from Edinburgh eight years ago when the Corporation established its electrical undertaking.

MESSRS. H. LEWIS & FLETCHER, Cardiff, have been appointed consulting engineers to supervise the working of the Whitchurch electric lighting system, and MR. CHARLES SALMON has been appointed engineer in charge of the works.

On his departure to take up an appointment abroad, MR. J. HASDELL was presented with a handsome travelling bag subscribed for by the whole of the staff and employés of the Eccles Corporation Electricity Department. The borough electrical engineer, Mr. H. W. Angus, in making the presentation, testified to the able and efficient manner in which Mr. Hasdell had always carried out his duties as shift engineer, and to the general esteem in which he was held during his two and a half years' service.

MR. W. T. LE FEUVRE, borough electrical engineer of Bexhill, has returned to duty. Three months ago he met with an accident to his leg when undergoing training as an Engineer Officer at Chatham, and he is still lame. In appreciation of the able manner in which the assistant electrical engineer (MR. C. A. FROST) has managed the works in the absence of the chief engineer, the Council has made him a special grant of £25.

MR. W. B. HOBERDEN, assistant electrical engineer at Stockton-on-Tees, has resigned.

General.—With reference to our leaderette of last week on the New Year Honours, we omitted to include in the small circle of those to whom we tendered our congratulations, SIR ROBERT A. LISTER, one of the new knights, who has been chairman of Messrs. Mawdsley's, Ltd., of Dursley, Glos., since the incorporation of the company.

MR. THOMAS SCHARFFETTER, A.M.I.E.E., of 81, Peter Street, Manchester, has been appointed sub-agent for Lancashire for Messrs. Felten & Guilleaume's cables, rail bonds and rubber manufactures.

MR. CHAS. GORICK, who has represented the Ecco Battery and Electrical Co. during the last three years, has severed his connection with that firm.

MR. W. W. DAVIES, Ynyswen, Treorky, the chief electrician of the Abergorky Collieries, has been appointed to a similar post under the Amalgamated Gold Mines Co., Ltd., in West Africa, and, after nine years' service at Abergorky, he was presented by his colleagues on his departure last week with a suitably inscribed dressing case and a purse of gold, as tokens of regard and esteem.

MR. J. N. SOUTHERN, who has been connected with the Chloride Electrical Storage Co., Ltd., for the last seven years, has joined the firm of Messrs. Boulton & Paul, Ltd., Norwich, and will act as manager of their electrical department.

According to the *Manchester Courier*, SIR W. H. PREECE, K.C.B., leaves England on Saturday next for Cape Town.

MR. P. W. FREUDEMACHER, A.M.I.E.E., formerly in the sales department of Messrs. Crompton & Co., Ltd., has opened on his own account, under the style of P. F. Williams & Co., at 34, Bargery Road, Catford, S.E. The new firm is specialising in the manufacture and installation of organ-blowing plant, both electrical and mechanical. Mr. Freudemacher, himself an organist, has had a unique experience in this class of work and we wish him every success in his new venture.

Obituary.—MR. J. W. A. KNOX.—We regret to announce the death, at the age of 57 years, of Mr. Knox, which occurred at his residence, Airlie Gardens, Ilford, after a brief illness. He was associated with the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd. (as one of their chief electricians), and was in their service for a period extending to nearly 40 years. The interment took place at the City of London Cemetery, Ilford, on Wednesday, 4th inst., and was largely attended by his numerous friends and colleagues. Among the chief mourners were Messrs. Best, McNaught, Tall and Bawcutt, representing heads of departments with whom he was closely associated. Amongst others at the graveside were Mr. P. M. S. Brodie (works manager), Captain Morton, Captain Robinson, Messrs. J. Rymer-Jones, Gostling, Ely, Tanner, Ricketts, Hill, Cosh, Stevenson, Willsher, Dykes, White, &c. The widow and family desire to express their heartfelt thanks for the expressions of sympathy received from numerous sources.

CITY NOTES.

Prospectus.—*Electric Power Plants, Ltd.*—A prospectus is now in circulation inviting applications until January 19th (Thursday next) for 9,936 6 per cent. cumulative preference shares of £1 each in this company. The directors are Messrs. P. J. Mitchell, C. O. Bastian, and D. Campbell, while A. W. Stanton, solicitor, joins the board after the directors have gone to allotment. Mr. A. H. Gibbings will act as general manager for a period of five years at £500 per annum. The nominal capital is £15,000 in 10,000 preference, and 5,000 ordinary shares, all of £1 each. £4,993 in ordinary shares is payable as purchase price to the vendors who are also the promoters of the company (£3,993 to Mr. Gibbings, and £1,000 to Mr. Mitchell or their nominees). The present company is a development company which has been formed to enter into contracts on behalf of, and for resale to, a larger company to be formed. Messrs. Gibbings and Mitchell, as the result of inquiries in Lancashire, South Wales, Yorkshire, Scotland and other industrial centres, have ascertained that power-users, while fully appreciating the advantages of recovering power from their waste steam, are not, in some cases, prepared to embark upon the capital outlay necessary for the plant required, while, in others, they are sceptical as to its advantages and will not incur expenditure thereupon until they are satisfied as to the benefit to be obtained. The company is, therefore, to initiate a scheme under which the plant will be installed on the principle of payment by results. Contracts can be made for installation of plant in return for payment based on the amount of power produced by the plant to the user, which, while effecting a saving to the user, would prove highly remunerative to the contractor supplying the power. The details of the scheme have been placed before several power users, who have, as a result, entered into negotiations to supply plant to a number of firms, but capital is required for the development of the scheme and for making contracts. Messrs. Mitchell and Gibbings will, therefore, sell to the company the information and data collected by them, and the negotiations that they have entered into, for the consideration named above. "The company propose to enter into contracts to supply and install complete plants free of initial expense to the user at a charge for the electrical energy generated by the plant at a rate which will vary according to the conditions obtaining in each case. These contracts will be provisional until acquired by the proposed larger company." If sufficient of the shares now offered are taken up one or more plants will be purchased by the company and installed so as to provide practical demonstration of the benefits; this, it is expected, will increase the value of the assets on resale. At the date of winding up the preference shareholders will share the surplus assets, *pari passu*, with the ordinary shareholders. Among other statements appearing in the prospectus is one to the effect that Mr. Mitchell has been instrumental in installing over 70 exhaust steam plants in the United Kingdom and the Colonies, producing power, at a saving to users, which is estimated by him to be at least £300,000 per annum as compared with power obtained from a supply company.

Continental.—FRANCE.—The balance-sheet of La Société Industrielle des Telephones, of Paris, shows a net profit of £67,651 for the last financial year, as compared with £78,032 in the preceding 12 months. The dividend is being reduced from 16¼ to 15 fr. per share.

GERMANY.—The Telephon Fabrik Gesellschaft (J. Berliner), of Berlin, is declaring a dividend of 12 per cent. for the last financial year.

Dublin United Tramways Co. (1896), Ltd.—The directors have declared a dividend for the half-year to December 31st at the rate of 6 per cent. per annum, less income-tax, on both the preference and ordinary shares, after setting aside £12,000 towards the renewal of permanent way, and carrying forward £9,898.

Japan.—The Yokohama Electric Light Co. is declaring a dividend of 13 per cent. for the last financial year.

Mexican Light and Power Co.—A dividend of 1 per cent. on the ordinary shares for the quarter ended December 31st, is payable January 20th.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Route miles open. Inc.
Aberdeen	Jan. 8	3,0 9	+ 116	31	45,048	+ 843	..	..
Ayr	„ 7	425	+ 26	34	11,134	+ 418	8	..
Bath	„ 7	1,653	+ 27	..	..	..	..	..
Belfast	„ 6	8,683	+1,011	40	165,333	+10,849	37	..
Birkenhead	„ 8	2,294	— 65	40	44,786	+ 1,00	13·68	..
Birmingham Corp.	Dec. 31	16,117	+1,301	39	270,915	+ 7,154	56·8	..
Blackburn	Jan. 4	2,442	+ 83	40⅔	48,779	— 1,047	14·6	..
Blackpool Corp.	„ 5	1,039	+ 103	..	51,405	+ 570	..	..
Blackpool-Fleetw'd	Dec. 31	599	+ 119	26	23,766	+ 784	..	..
Bolton	Jan. 8	5,546	+ 415	41	97,362	+ 1,669	26	..
Bournemouth	„ 4	3,259	+ 88	39⅔	73,118	+ 5,422	21·95	..
Bradford	„ 7	10,684	+ 482	41	207,346	+ 9,320	54·81	..
Brighton	„ 8	1,647	— 10	40⅔	40,515	+ 458	9·5	..
Bristol	„ 8	13,304	+1,187	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Dec. 30	431	+ 1	52	11,395	+ 82	3·65	..
Barnsley	„ 30	411	+ 9	52	9,037	+ 224	..	..
Barrow	„ 30	516	+ 34	52	13,697	+ 1,687	5·37	..
Cavehill	„ 30	159	+ 19	52	4,596	+ 265	..	..
Devonport	„ 30	1,007	+ 142	52	22,404	+ 3,228	8·85	..
Gateshead	„ 30	2,221	+ 6	52	51,879	— 21	11·25	..
Gravesend	„ 30	497	+ 24	52	10,855	— 115	6·5	..
Greenock	„ 30	1,096	+ 32	52	31,492	+ 2,861	7·25	..
Hartlepool	„ 30	459	— 45	52	12,670	+ 433	6·72	..
Kidderminster	„ 30	251	+ 11	52	5,756	+ 175	..	..
‡Leamington	„ 30	311	+ 7	52	8,734	— 352	..	..
Merthyr	„ 30	452	— 2	52	10,747	— 137	2·9	..
Metropolitan	„ 30	17,790	+3,026	52	392,459	+66,708	22	..
Middleton	„ 30	629	+ 104	52	16,344	— 690	8·5	..
Mid.Joint Com'tee	„ 30	13,087	+ 337	52	306,337	+ 5,142	..	..
Oldham—Ashton	„ 30	1,170	+ 105	52	28,907	— 47	9·13	..
Peterborough	„ 30	288	+ 9	52	6,096	— 54	5·31	..
Potteries	„ 30	4,407	+ 5·4	52	94,539	+ 439	29	..
Rothesay	„ 30	88	— 5	52	10,155	+ 173	2·75	..
Southport	„ 30	520	+ 87	52	10,059	+ 444	8·17	..
S. Metropolitan	„ 30	1,813	+ 34	52	42,569	+ 1,147	..	..
Swansea	„ 30	2,509	+ 289	52	56,761	+ 5,610	12·5	..
Tynemouth	„ 30	324	+ 17	52	12,901	+ 580	3·75	..
Weston-s-Mare	„ 30	72	..	52	7,213	— 21	3	..
‡Worcester	„ 30	591	+ 30	52	14,756	+ 345	5·75	..
Wrexham	„ 30	233	..	52	5,084	— 36	..	..
Yorks. Wool. Dist.	„ 30	2,341	+ 380	52	51,810	+ 3,809	17	..
Miscellaneous	„ 30	433	— 15	52	11,018	+ 179	..	..
Burnley	Jan. 7	2,818	+ 149	..	..	..	11·73	..
Burton-on-Trent	„ 8	562	+ 12	40	11,168	+ 325	9·7	..
Bury	„ 8	2,528	+ 169	40⅔	48,388	+ 759	22·5	..
Cardiff	Dec. 31	4,922	+ 481	40	89,930	+ 1,925	..	..
Carlisle	..	..	..	..	..	..	..	..
Chatham and Dist.	Jan. 5	1,756	+ 18	..	..	..	14·98	..
Cork	„ 5	967	— 2	..	..	..	9·89	..
†Croydon	..	..	..	..	..	..	..	..
†Darlington	„ 7	201	+ 18	41	8,276	+ 702	..	..
†Darwen	Dec. 30	260	+ 26	39	9,836	+ 2	4·36	..
Dover	„ 31	417	+ 55	39	8,892	+ 452	4·75	..
Dublin	Jan. 6	10,036	+ 515	..	..	..	54·25	..
Dundee	„ 4	3,669	— 103	33⅓	40,662	+ 605	15	..
East Ham	„ 7	2,110	+ 50	40⅔	42,231	+ 1,853	14	..
†Exeter	Dec. 30	864	+ 33	40	12,812	— 528	5·5	..
Glasgow	Jan. 7	39,342	+2,005	..	568,575	+33,172	..	..
Hastings	„ 9	1,748	+ 30	..	..	..	..	..
†Huddersfield	..	..	..	..	..	..	..	..
Hull	„ 7	5,994	+ 251	40	111,807	+ 5,802	14·5	..
Ilkeston	„ 5	244	— 5	40	5,198	— 218	..	..
†Ipswich	„ 7	736	+ 23	40	17,812	+ 968	10·5	..
†Kilmarnock	Dec. 31	169	— 4	33	5,061	— 214	4·25	..
Lancashire United	Jan. 4	3,322	+ 451	..	..	..	39	..
Leeds	„ 7	14,489	+ 354	40	285,679	+10,080	57	..
Leicester	..	..	..	..	..	..	..	..
Leith	„ 7	1,221	— 48	33⅓	20,679	+ 76	8·72	..
Liverpool	Dec. 31	24,478	+1,884	..	..	..	116	6·5
‡L.C.C.	„ 28	89,340	+7,818	..	1,633,290	+181,056	133	4·4
London United	Jan. 7	11,749	— 77	..	..	..	..	..
Lowestoft	..	..	..	..	..	..	..	..
Manchester	Dec. 31	32,522	+3,227	39	609,202	+17,898	105	1
†Newcastle	Jan. 7	4,091	— 19	..	159,927	+ 1,032	14·5	..
Newport	Dec. 31	1,548	+ 116	40	27,028	+ 1,031	14·5	..
Oldham	Jan. 8	3,762	+ 313	41	76,345	+ 1,225	43·5	·5
Pontypridd	..	..	..	..	..	..	..	..
Portsmouth	„ 7	3,477	+ 297	40	83,955	— 1,210	15·25	..
Preston	„ 4	1,589	+ 8	40	29,528	— 124	..	..
Rotherham	..	..	..	..	..	..	..	..
Salford	„ 2	9,985	+ 380	39⅔	186,142	+ 5,031	..	..
Sheffield	„ 10	13,405	+ 808	40	250,422	+15,510	40	..
Southampton	„ 4	2,297	+ 156	40	44,544	+ 1,463	..	..
Southend-on-Sea	„ 4	840	+ 61	40	24,186	+ 2,661	..	..
South Shields	„ 7	1,174	— 5	40⅞	22,810	— 78	..	..
Swindon	„ 4	318	+ 21	..	5,819	+ 319	..	..
Tyneside	Dec. 31	689	+ 60	27	11,252	— 11	..	..
Wallasey	Jan. 7	1,983	+ 206	40⅔	39,021	+ 1,618	..	..
Walthamstow	„ 7	1,349	+ 40	40	28,818	+ 2,038	9	..
West Ham	Dec. 29	5,695	+ 507	39	97,706	+ 5,326	15·25	..
Wolverhampton	Jan. 4	2,205	+ 136	40	37,998	+ 3,989	14·25	..
Cen. London Rly.	„ 7	10,045	— 411	..	..	..	6·22	..
City & S. Lon. Rly.	„ 8	7,813	+ 579	..	..	..	7·26	..
Dublin-Lucan Rly.	„ 6	251	+ 31	..	..	..	7	..
G.N. and City Rly.	„ 7	3,090	— 24	..	..	..	3·5	..
L'pool Overh'd Rly.	„ 8	2,781	+ 139	..	..	..	6·8	4·3
Llandudno-Col. Bay	„ 6	805	+ 15	5½	660	..	..	..
London Elec. Ry. Co.	„ 7	28,440	+1,385	..	..	..	21·25	..
Mersey Railway	„ 7	4,297	+ 75§	..	..	..	4·5	..
Metropolitan Rly.	„ 8	35,831	+1,133	..	..	..	24·5	..
Met. District Rly.	„ 7	23,138	+1,828	..	..	..	24	..
Anglo-Argentine	„ 7	109,865	+17,762	..	..	..	..	..
§Auckland	Dec.	16,171	+1,241	..	91,989	+ 9,863	23·3	1
Bombay (B.E.T.)	Nov. 25	6,069	+ 53	47	129,442	+ 9,572	..	..
§Brisbane	Nov.	18,780	+2,560	44	200,420	+20,428	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Jan. 7	8,058	+ 534	..	..	..	..	..
§Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Nov.	3,385	..	..	39,037	..	20·5	..
§Lisbon	Dec.	1,699	+ 120	..	33,020	+ 1,510	..	..
Madras	Dec. 15	1,435	+ 80	..	31,121	+ 58	..	..
§Montevideo	Dec.	26,674	+1,674	..	..	..	..	..
†Perth (W.A.)	Jan. 6	4,027	+ 117	..	..	..	29	1

* Compared with the corresponding period of 1909. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

BUSINESS in the Stock Exchange does not show that disposition to rush along in the brilliant fashion which members fondly expected, before Christmas, that it might do in the New Year. Rather has it descended to a kind of gentle trickle, much of it of the investment order, but far from exciting, and therefore provocative of much disappointment. The failure of the Bank Rate to come down on the first Thursday in the New Year made another cause for regret. Altogether the Stock Exchange is not particularly well pleased with 1911.

Rumour has been rife that the Brighton Railway intended to proceed very shortly with the work of electrifying the main line, and circumstantial figures were afforded as to the manner in which the necessary new capital would be raised. The company, however, promptly denied that any fresh issue of stock was in immediate contemplation, from which the inference was naturally drawn that electrification of the trunk line will have to wait. It is further assumed that the probable delay on the part of the Brighton Railway will influence similar schemes which other big companies have on hand, and the various half-yearly meetings of proprietors to be held in February and March will be awaited with considerable curiosity in regard to this point.

Central London Deferred stock has advanced, and there is a little investment demand for City and South London Ordinary. East London hardened to 4¼, making the third Debenture stock—that truly gilt-edged security!—look cheap at 5. A remarkable feature of the opening days of 1911 was the general hardening of Home Railway Debenture and Preference stocks, in which movement the Undergrounds shared to some small extent. Districts and Metropolitans have been inclined to dulness.

The new issue of shares by the Rio Tramway Company brought in any number of selling orders in small amounts to the market, so much so that one firm of dealers at last declined to buy any more "bits." Other people gave what worked out to about three-halfpence per Rio old share, after starting a market in them on the basis of sixpence to a shilling premium. The existing shares have been up to 106½, but, on being quoted *ex* rights, went back to 105½, from which they hardened up again.

Mexico Tramways enjoyed a good deal of quiet support towards the end of last week, and the buying is found reflected in a fair rise in the price. Other issues in the group are very steady, and quotations readily respond to a little buying. The progress in net earnings made during the first eleven months of 1910 by four of the best known companies is so marked that the figures deserve to be set out :—

Company.	1909.	1910.	Increase.
Mexico Tramways	$2,473,398	$2,735,461	$262,063
Mexican Light and Power	$2,603,922	$4,627,954	$2,024,032
Rio de Janeiro Trams	£571,577	£1,006,449	£434,872
Sao Paulo Trams	$1,370,908	$1,705,597	$334,689

In the manufacturing section a nominal fall of 5 points in Crompton Debenture is one more instance of how artificial prices can become when business in the stock shrink to nothing. Crompton Debenture, in the absence of any orders, was supposed to be about 80 *ex* dividend. A seller came in, found that there was no chance of his getting even the nominal price, and, therefore, marked it down 5 points. Whether this enabled him to realise the stock we don't know, but take leave rather to doubt it.

The Telegraph section maintains its firmness, without material change in prices. Speculation is still active in Anglo "A," and the 6 per cent. Preferred has been fluctuating between 115½ and 114½. West India and Panama Ordinary rose to 2⅛, to revert to 1 15/16, the attraction of a £10 share at so low a price having brought in buyers lower down who were glad to get out at anything over 2. In Telephone issues the tendency has been hard, with business very quiet.

Direct United States Cable Co., Ltd.—The directors recommend an interim dividend of 4s. per share, together with a bonus of 2s. per share, both free of income-tax, payable on and after 31st inst., making with the interim dividend already paid a total distribution of 5 per cent. for the half-year ended December 31st last. After placing £5,000 to reserve fund account, there will be carried forward a balance of about £4,705. The transfer books will be closed from January 10th to 24th.

Mexico Tramways Co.—A dividend of 1¾ per cent. on the issued capital stock for the quarter ended December 31st, is payable in Toronto, February 1st.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1907.	1908.	1909.	1910.	Closing Quotations Jan. 3rd.	Closing Quotations Jan. 10th.	Business done week ended Jan. 10th, 1911. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	5⅜ — 6⅛	5⅜ — 6¼	..	..	..	Nil.
286,500	Do. 5 % Deb. Red. Iss. at 98 % script all paid	Stock	5 %	5 %	5 %	..	96 — 98 xd	96 — 98	97	..	..	5 2 0
$255,196,000	American Telephone & Telegraph, Cap Stock	$100	8 %	8 %	8 %	..	144 —146 xd	145 —147	145⅞	..	+ ½	5 8 10
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	..	93 — 95 xd	93 — 95	..	..	..	4 4 3
558,460	Anglo-American Telegraph	Stock	3⅛%	£3 4s.	3⅛%	..	71 — 73	71 — 73	..	..	..	4 19 4
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	..	114½—116½	114 —116	115⅝	114⅜	..	5 3 0
3,220,770	Do. do. do. Deferred	Stock	1 %	8/-	25/-	..	28⅜— 29	28¾ — 29⅛	28¾	28 7/16	— ⅛	4 5 8
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	..	102 —104	102 —104	..	..	..	4 16 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7 — 7¼	7 — 7¼	7 3/16	..	..	5 10 4
2,449,176	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	..	84 — 86 xd	84 — 86	85⅛	84	..	4 13 0
16,000	Cuba Telegraph	10	6 %	6 %	6 %	..	8⅝— 9⅝	8⅝— 9⅝	9 1/16	..	..	6 11 6
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	..	16½— 17½	16½— 17½	..	..	..	5 16 9
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3⅜— 3⅝	3⅜— 3⅝	3⅝	..	..	4 17 10
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	..	8¼— 8⅝	8¼— 8⅝	..	..	..	5 14 3
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	..	99 —101 xd	99 —101	..	..	..	4 9 1
60,710‡	Direct United States Cable	20	4½%	4½%	4 %	..	15⅝— 16⅛	15⅞ — 16⅛	15⅞	15⅝	+ ¼	4 17 10
	Direct W. India Cable, 4½% Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	..	99 —101 xd	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	135 —138	135 —138	136¾	135	..	5 1 5
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	..	83 — 85	84 — 86	85¼	84⅞	+ 1	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	4 %	4 %	..	99½—101½	99½—101½	101	100¾	..	3 18 10
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	12⅝— 13⅜	12⅝ — 13¼	13¼	13 1/16	..	5 6 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	..	100 —102	100 —102	..	..	..	3 18 5
200,000‡	East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	..	99½—101½	99½—101½	..	..	..	3 18 10
181,127	Globe Telegraph and Trust	10	5⅞%	5⅞%	5⅞%	..	10½— 10⅝	10½— 10⅝	10 11/16	10 7/16	..	5 9 5
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	13½— 13⅝	13½— 13⅝	13⅝	..	..	4 8 1
150,000	Great Northern Telegraph, of Copenhagen	10	20 %	18 %	18 %	..	31½— 32½	31½— 32½	32⅝	..	..	5 10 9
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	..	53 — 55	53 — 55	54⅛	..	..	5 18 7
$41,380,400	Mackay Companies Common	$100	4 %	4 %	4½%	..	92 — 94	93 — 96	..	..	+1½	4 8 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	..	76 — 78	77 — 79	..	..	+1	5 1 3
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	3/16— 3/8	3⅛ — 3⅜	15/-	14/-	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	..	¾— 1	¾— 1	..	..	..	6 0 0
86,492	Do. do. 5 % Pref.	1	5 %	5 %	5 %	..	25/32— 29/32	25/32— 29/32	..	..	..	5 11 1
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	..	106½—107½	106½—107½	107⅛	106½	..	5 11 10
3,725,000	Do. do. Def. Stock	100	6 %	6 %	6 %	..	128 —130	128 —130	128⅛	128	+ ½	4 12 4
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	..	10½— 10⅝	10½— 10⅝	..	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	..	10½— 10⅝	10½— 10⅝	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	..	5⅛— 5⅜	5⅛— 5⅜	5⅛	..	..	4 7 11
2,000,000	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	..	97½— 99½ xd	97½— 99½	..	..	..	3 10 4
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	97½— 99½ xd	98 —100	..	..	+ ⅛	4 0 0
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid.	1	8 %	8 %	8 %	..	1 5/16— 1 7/16	1 5/16— 1 11/16	31/6	..	..	4 14 10
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	..	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..	4 7 3
195,955	Do. do. do. 4 % Red. Deb. Stock	100	4 %	4 %	4 %	..	86½— 88½ xd	87 — 89	88⅛	88	+ ½	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	..	97 — 99 xd	97 — 99	..	..	..	4 0 10
11,839	Reuter's	8	5 %	5 %	5 %	..	7½ — 8	7⅛ — 8	..	..	..	5 0 0
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	..	96 — 98 xd	96½— 9·½	96½	..	+ ½	4 11 5
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	132 —135	132 —135	132½	..	..	4 8 11
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	7⅞— 7⅞ xd	7 7/16— 7 7/16	7 7/16	..	+ 1/16	5 6 8
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5⅝— 5⅞ xd	5⅛ — 5⅜	5⅛	..	..	4 6 11
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1 3/16— 1 5/16	1¼ — 1½	26/3	25/-	+ 1/16	4 3 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	..	97 — 99 xd	97 — 99	..	..	..	4 0 10
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930	10	7 %	7 %	7 %	..	13½— 14 xd	13½— 14	13 15/16	13⅜	..	4 17 5
800,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	100 —102 xd	99 —101	99⅛	99	—1	3 19 3
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	1⅞— 2⅛	1⅞— 2	41/3	38/-	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	..	9⅛— 10	9⅜ — 10⅛	10⅛	9 13/16	+ 3/16	5 17 1
4,669	Do. do. 6 % Cum. 2nd Pref.	10	£2 6	15 %	14½%	..	8¾— 9¼	8¾ — 9¼	8⅞	..	..	6 9 9
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	..	100 —102 xd	100 —102	..	..	..	4 18 10

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000	5	..	..	5 %	..	4¾— 5 xd	4¾— 5	98/9	97/-	..	5 0 0
500,000	Do. 5 % 2nd Pref., 800,000 to 1,300,000	5	..	..	5 %	..	4 5/16— 4 3/16 xd	4 5/16— 4 3/16	£9/-	87/6	..	5 6 8
4,465,674	Do. 4 % Deb. Stock	Stock	..	4 %	4 %	..	91 — 93 xd	91 — 93	92¾	91⅝	..	4 6 0
332,387	Auckland E. Trams, 5 % 1st Mort Deb. Stock	100	5 %	5 %	5 %	..	101 —103 xd	101½—103½	103	..	+ ½	4 16 7
830,000	Babcock & Wilcox, 1 to 830,000	1	20 %	20 %	24 %	..	5⅜— 5⅞	5⅜— 5⅞	5 13/16	..	..	4 2 7
100,000.	Do. do. 6 % Cum. Pref., 1 to 100,000	1	6 %	6 %	6 %	..	1⅜— 1½	1⅜— 1½	..	..	..	4 0 0
1,000,000	British Aluminium 5 % Mort. Debs. Red.	100	..	..	..	..	..	..	..	..	..	5 8 1
500,000	British Columbia E. Rail Def. Ord. Stock	100	8 %	8 %	8 %	..	142½—145½ xd	145 —148	146½	144½	+ 2½	4 13 9
400,000	Do. Pref. Ord. Stock	100	5 %	6 %	6 %	..	123 —127	125 —128	127½	126	+ 1½	4 14 6
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	..	111 —114	111 —114	114	113	..	4 8 1
233,000	Do. 4½ % 1st Mort. Deb., 1 to 6,250	40	4½%	4½%	4½%	..	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	..	102 —105	102 —105	..	..	..	4 5 9
133,301	British Electric Traction	10	Nil	Nil	Nil	..	1 — 1⅛	1⅛ — 1⅜	28/9	22/6	+ ⅛	Nil
161,437	Do. do. 6 % Cum. Pref.	10	3 %	1½%	Nil	..	3½— 4	3⅝ — 4⅛	80/-	73/9	+ ⅛	Nil
1,473,653	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	..	89 — 93	90 — 94	92⅜	90½	+1	5 6 5
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	74 — 79	72 — 77	75½	74½	—2	5 16 11
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	..	6⅞— 7⅛	6⅞— 7⅛	7 1/16	..	..	6 17 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	..	5⅞— 6	5⅞— 6⅛	..	..	+ ⅛	4 16 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	..	99 —102 xd	99 —102	..	..	..	4 8 3
201,579‡	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	..	98 —101	98 —101	..	..	..	4 9 1
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 275,000	5	Nil	Nil	Nil	..	⅛— ¼	¼ — ½	..	..	..	Nil
1,316,353	Do. do. 4 % Mort. Deb. Stock	100	4 %	4 %	4 %	..	57 — 60 xd	57 — 60	59	..	..	6 13 4
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	2/16— 3/16	2/16— 3/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	..	37 — 42	37 — 42	..	..	..	10 14 4
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	..	21 — 25 xd	21 — 25	..	..	..	18 0 0
137,610	Calcutta Trams, 1 to 137,610	5	6 %	4½%	4½%	..	4⅜— 5	4¼ — 5	98/9	..	..	4 10 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,330	5	5 %	5 %	5 %	..	4⅜— 5 xd	4⅜ — 5	5	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	..	98 —101	96 — 99 xd	97½	97	..	4 10 11
85,000	Callender's Cable Construction shares	5	15 %	15 %	10 %	..	9⅞— 9⅝	9⅜ — 9⅝	..	..	..	5 3 3
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	4 15/16— 5⅛	4 15/16— 5⅛	98/1½	96/3	..	4 18 9
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	..	102 —104	102 —104	..	..	..	4 6 7
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	15/16— 1	15/16— 1	10/3	9/9	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	12 %	12½%	17½%	..	3— 3⅛	3 3/16— 3 5/16	65/-	61/-	+ ⅛	5 6 1
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4 %	4½%	..	105 —108	105 —108	..	..	..	4 3 4
1,890,690	Central London Railway, Ord. Stock	Stock	3 %	3½%	3 %	..	63 — 65	63 — 65	64¼	63½	..	4 12 4
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	..	85 — 87	85 — 87	..	..	..	4 12 0
554,655	Do. do. Def. do.	Stock	2 %	2½%	2 %	..	44 — 46	45 — 47	..	..	+1	4 5 1
1,480,000	City and South London Railway	Stock	2½%	1½%	1⅜%	..	28½— 29½	28¾ — 29½	29⅛	28⅝	..	5 18 8
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	Nil	Nil	..	⅜— ½	⅜ — ½	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	..	77 — 82 xd	70 — 80	..	..	—4½	6 0 5

* Unless otherwise stated, all shares are fully paid.

‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Jan. 3rd.	Closing Quotations Jan. 10th.	Business done week ended Jan. 10th, 1911.		Rise + or Fall —	Present Yield per cent.
		*	1907.	1908.	1909.	1910.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	6 %	5 %	..	7/— 1	13/— 15	..	..	— 1/16	5 6 8
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	..	1/— 1	1/— 1 1/16	..	..	..	6 0 0
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	..	97 —100 xd	97 —100	..	..	..	4 10 0
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	..	12⅜ — 13⅛	12⅜ — 13⅛	..	..	..	4 8 11
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	2½%	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
17,139	Do. "A" shares, 01—017,139	5	2½%	Nil	Nil	..	1 — 1⅛	1 — 1⅛	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	61 — 66 xd	61 — 66	..	..	..	6 1 3
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	77 — 80	77 — 80	..	..	..	6 5 0
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	⅜ — ⅝	⅜ — ⅝	13/6	11/9	+ ⅛	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	..	1⅜ — 1⅝	1⅜ — 1⅝	35/-	..	..	7 9 4
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	8 — 8½ xd	8 — 8½	8⅛	..	..	5 17 8
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	..	80 — 84	80 — 84	..	..	..	4 15 3
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	⅜%	Nil	Nil	..	⅜ — 1	⅜ — 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½ — 10⅝	10¼ — 10⅜	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 —103⅜	102 —103⅜	..	..	..	4 16 10
40,000	Henley's (W.T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	..	12¼ — 12⅝	12¼ — 12⅝	..	..	..	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	..	5 1/16 — 5⅛	5 — 5⅛	5⅛	..	— 1/16	5 4 8
150,000	Do. do. 4½ % Mort. Deb Stock	Stock	4½%	4½%	4½%	..	107 —109	107 —109	..	..	..	4 5 9
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	..	15 — 15⅝ xd	15 — 15⅝	15 15/16	15⅝	..	6 7 0
37,500	†Liverpool Overhead Railway, Ord.	10	⅜%	Nil	Nil	..	1 1/16 — 1⅛	1⅛ — 1⅛	..	..	+ 1/16	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	..	6⅞ — 7⅛	6¾ — 7⅛	..	..	..	6 15 7
600,070	London United Trams. (1901) 1 to 50,007	10	3 %	Nil	..	..	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
399,930	Do. do. 60,008 to 100,000	10	3 %	Nil	..	..	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	3 3/16%	Nil	..	1⅜ — 2⅜	1⅜ — 2⅜	40/-	36/3	..	..
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	..	65 — 69 xd	65 — 69	66⅛	65½	..	5 15 11
5,732,062	Metropolitan Consolidated	100	⅜%	⅜%	1 %	..	40⅞ — 41¼	40⅞ — 41¼	41¼	40⅞	..	2 8 6
2,640,914	Do. Surplus Lands	100	2 3/16%	2 3/16%	2 3/16%	..	64 — 66	64 — 66	65⅛	64½	..	4 3 4
3,235,000	Do. District	100	Nil	Nil	Nil	..	27⅛ — 28	26⅞ — 27⅛	27⅜	26⅝	— ⅜	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	4 1/16%	5%	..	5/16 — 7/16	5/16 — 7/16	16/6	..	..	5 14 3
314,016	Do. do. Defd.	1	Nil	Nil	..	..	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	15/16 — 1 1/16	15/16 — 1 1/16	18/-	17/9	..	5 6 8
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	..	98 —100 xd	99 —101	100⅜	99½	+1	4 9 1
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	6 %	..	123 —12	125 —127	126½	126¼	+2	4 14 6
$9,000,000	Do. 1st Mort. 50-year 5 % Gld. Bds.	..	..	..	5 %	..	96½ — 97⅛	96⅜ — 97⅛	97⅛	97	+ ⅛	5 2 4
245,500	Potteries Electric Traction	1	4 %	Nil	..	..	1/16 — 1/8	1/16 — 1/16	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	⅛ — ¼	⅛ — ¼	..	..	..	7 5 5
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	..	80 — 83	80 — 83	..	..	..	5 8 5
37,350	Telegraph Construction and Maintenance	12	17½%	15 %	17½%	..	38 — 40	38 — 40	..	..	..	5 9 5
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	..	99 —101 xd	99½—101½	..	..	+ ⅛	3 18 10
1,000,000	Underground Electric Railway, 5 % Prior Lien	..	..	5 %	..	..	101 —102	101½—102⅛	102⅜	101⅞	+ ⅛	4 17 7
2,800,000	Do. do. 4½ % Bonds	..	..	4½%	4½%	..	93 — 95 xd	94 — 96	94½	93½	+1	4 13 3
4,900,000	Do. do. 6 % Income Bonds	..	..	..	..	..	38 — 40	38 — 40	39¼	39	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	10 %	5 %	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	6 %	3 %	..	1 — 1⅛	1 — 1⅛	..	..	..	10 0 0
245,495	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	..	55 — 65	55 — 65	..	..	..	6 3 1

ELECTRICITY SUPPLY COMPANIES.

30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	..	6⅞ — 7⅛	6⅞ — 7⅛	7 1/16	..	..	6 15 7
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	4 14 11
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	..	99 —102	98 —102	99⅓	..	— ⅓	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	..	3⅝ — 4⅛	3⅝ — 4⅛	78/9	76/3	..	5 19 5
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	..	4⅛ — 4⅜	4⅛ — 4⅜	88/9	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	..	3⅝ — 4⅛ xd	3⅝ — 4⅛	73/9	..	..	5 7 6
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	95 — 97 xd	95 — 97	95½	..	..	4 2 6
49,436	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	..	3⅛ — 3⅜	3⅛ — 3⅜	..	..	+ ⅛	6 0 0
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	..	97 — 99	98 —100	97½	..	+1	4 10 0
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	7 %	..	11 — 11⅛	11⅛ — 11⅝	11⅛	11⅛	+ ⅛	6 1 9
40,060	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	..	11⅜ — 12⅝	11⅜ — 12⅝	..	..	..	4 16 0
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	..	118 —122 xd	118 —122	120⅛	..	..	4 2 0
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	..	98 —101 xd	98 —101	100	..	..	4 9 1
50,000	County of Durham Electrical Power, Ord.	5	2 %	Nil	Nil	..	1⅝ — 2	1⅝ — 2	..	..	..	Nil
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	..	2⅝ — 3⅛	2⅝ — 3⅛	..	..	..	7 16 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	5 %	5 %	..	92 — 94 xd	92 — 94	..	..	..	5 6 5
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	..	7⅜ — 7⅞	7⅜ — 7⅞	..	..	..	6 7 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	..	10⅜ — 11	10½ — 11	10 15/16	..	..	5 9 1
400,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	..	104 —107 xd	104 —107	105⅜	..	..	4 4 1
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	..	98 —101	98 —101	..	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	..	⅝ — ¾	⅝ — ¾	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	Nil	Nil	Nil	..	1⅝ — 2	1⅝ — 2	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	74 — 77	74 — 77	75½	..	..	5 16 11
$8,150,000	Electrical Dev. Co. of Ontario, 5%, 1st Mtg. Gold Bnds.	$500	..	5 %	5 %	..	81 — 83	81⅛ — 83½	83¼	82¾	+ ⅛	5 19 9
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	..	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	..	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	4 11 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	..	99 —102	99 —102	..	..	..	4 8 3
15,000	Hove, 1 to 15,000	5	8½%	8½%	8½%	..	6⅝ — 7⅛	6⅝ — 7⅛	..	..	..	5 19 4
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	5 %	5 %	..	101 —103 xd	101 —103	101¾	..	..	4 17 1
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	8 %	8 %	..	6½ — 7	6½ — 7	..	..	..	5 14 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	..	93 — 95	93 — 95	..	..	..	4 4 3
11,000	London Electric Supply Corporation, Limited, Ord.	3	2½%	3 %	2 %	..	1⅜ — 1⅞	1⅜ — 1⅞	..	..	+ ⅛	3 2 9
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	..	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	5 17 1
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4 %	4 %	..	89 — 92	89 — 92	..	..	..	4 7 0
200,000	Metropolitan Electric Supply, 1 to 100,000	5	6¾%	5 %	5 %	..	3⅛ — 3⅜	3⅜ — 3⅞	70/-	71/9	+ ⅛	6 9 0
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	..	4 — 4¼ xd	4⅛ — 4⅜	86/3	82/6	+ ⅛	4 11 5
235,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	..	100 —103 xd	100 —103	100⅛	..	..	4 7 5
248,000	Do. 3¾ % Mort. Deben. Stock Redem.	Stock	3¾%	3¾%	3¾%	..	82 — 85 xd	82 — 85	..	..	..	4 1 5
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	..	86 — 87 xd	86⅞ — 87½	87½	86¾	+ ⅛	5 14 3
13,585,000	Do. Light and Power Co., Ltd., Common	$100	4 %	3¾%	4 %	..	88⅞ — 90⅛	88⅞ — 90⅛	89⅜	89⅛	..	4 8 5
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	7 %	7 %	..	105 —107	105⅜—107⅛	107⅛	106¾	+ ⅛	6 10 3
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	5 %	5 %	..	92½ — 93½	94½ — 95⅛	95⅛	93¾	+2	5 4 9
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	..	95 — 97 xd	96 — 98	96	..	+1	4 11 10
180,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	2½%	..	..	3⅜ — 4⅛	3⅜ — 4⅛	..	..	..	2 12 9
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	..	4⅝ — 4⅞	4⅝ — 4⅞	..	..	..	5 2 7
150,000	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500	100	..	..	5 %	..	97⅛ — 99½	97⅛ — 99½	..	..	..	5 0 6
10,852	Notting Hill Electric Lighting	10	7⅜%	7 %	..	..	11⅛ — 12½	11⅛ — 12½	..	..	..	5 12 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6¼ — 6⅝	6¼ — 6⅝	..	..	..	5 3 8
119,694	River Plate Elcty. Co. Ord.	Stock	6 %	8 %	9 %	..	228—238	228 —238	..	..	..	3 15 8
100,000	Do. do. 6% Non Cum. Pref.	Stock	6 %	6 %	6 %	..	103—113	103 —113	..	..	..	5 6 2
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	..	98 —100 xd	101 —103	..	..	+3	4 17 1
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	..	7¼ — 7⅜	7¼ — 7⅜	..	..	..	6 9 0
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	..	6⅝ — 7⅛	6⅝ — 7⅛	..	..	..	4 0 6
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	..	85 — 87 xd	85 — 87	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	..	..	1⅝ — 2	1⅝ — 2	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	5 %	5 %	..	2⅞ — 3⅛	2⅞ — 3⅛	..	..	..	6 7 0
180,100	Do. do. 5 % 1st Mort. Deb.	100	..	5 %	5 %	..	97½—100¼xd	97½—100½	..	..	..	4 19 6
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	..	..	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	..	1 5/32 — 1 7/32	1 5/32 — 1 7/32	..	..	..	6 16 7
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	..	96 — 99	96 — 99	98	..	..	4 10 11
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	..	..	¾ — 1	¾ — 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	..	..	2 — 2½	1⅞ — 2⅛	37/6	..	— ⅛	11 2 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	..	80 — 83	80 — 83	..	..	..	5 8 5
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	5 %	..	..	⅜ — ⅞	⅜ — ⅞	..	..	..	5 14 3
100,000	Westminster Electric Supply, Ord.	5	10 %	10 %	10 %	..	7⅝ — 7⅞	7⅛ — 8	7 15/16	..	+ ⅛	6 5 0
51,279	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	..	4⅛ — 5⅛xd	5 — 5⅛	..	..	+ 1/16	4 3 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4½ per cent. December 1st, 1910.

TRADE STATISTICS OF BRITISH INDIA.

THE following figures, showing the imports of electrical and similar materials into India during the year ended March 31st, 1910, are taken from the recently issued official trade statistics; the details for the year ended March 31st, 1909, are added for purposes of comparison, and notes of any increases or decreases are given :—

15 rupees = £1.

	1908-9. Rupees.	1909-10. Rupees.	Increase or decrease. Rupees.
Lampware.—			
From Great Britain ...	10.92.000	9.10.000	— 1.82.000
„ Germany	5.55.000	5.84.000	+ 29.000
„ Austria	4.42.000	5.34.000	+ 92.000
„ United States ...	2.67.000	5.79.000	+ 3.12.000
„ Other countries ...	85.000	1.70.000	+ 85.000
Total ...	24.41.000	27.77.000	+ 3.36.000
Other hardware, except enamelled ware.—			
From Great Britain ...	1.39.71.000	1.26.61.000	—13.10.000
„ Germany	22.74.000	23.74.000	+ 1.00.000
„ Belgium	10.69.000	8.99.000	— 1.70.000
„ Austria	2.91.000	2.79.000	— 12.000
„ United States ...	6.88.000	7.85.000	+ 97.000
„ Other countries ...	7.57.000	6.82.000	— 75.000
Total ...	1.90.50.000	1.76.80.000	—13.70.000
Brass, wrought.—			
From Great Britain ...	7.05.000	5.41.000	— 1.64.000
„ Germany	2.51.000	49.000	— 2.02.000
„ Austria	70.000	48.000	— 22.000
„ Other countries ...	2.06.000	2.95.000	+ 89.000
Total ...	12.32.000	9.33.000	— 2.99.000
Copper and copper ware.—			
From Great Britain ...	1.71,97.000	1.49.82.000	—22.15.000
„ Germany	52.67.000	59.82.000	+ 7.15.000
„ Belgium	18.05.000	19.78.000	+ 1.73.000
„ Italy	4.37.000	3.64.000	— 73.000
„ Austria	1.70.000	1.77.000	+ 7.000
„ Japan	20.36.000	28.40.000	+ 8.04.000
„ Other countries ...	3.02.000	1.12.000	— 1.90.000
Total ...	2.72.14.000	2.64.35.000	— 7.79.000
Iron wire.—			
From Great Britain ...	1.33.000	95.000	— 38.000
„ Germany	54.000	13.000	— 41.000
„ Belgium	3.82.000	3.12.000	— 70.000
„ Other countries ...	1.09.000	1.52.000	+ 43.000
Total ...	6.78.000	5.72.000	— 1.06.000
Steel plates and sheets.—			
From Great Britain ...	75.59.000	76.71.000	+ 1.12.000
„ Germany	21.30.000	18.18.000	— 3.12.000
„ Belgium	27.91.000	25.28.000	— 2.63.000
„ Other countries ...	24.000	57.000	+ 33.000
Total ...	1.25.04.000	1.20.74.000	— 4.30.000
Steam engines (except locomotives).—			
From Great Britain ...	96.38.000	73.45.000	—22.93.000
„ Belgium	1.25.000	36.000	— 89.000
„ Other countries ...	3.29.000	2.90.000	— 39.000
Total ...	1.00.92.000	76.71.000	—24.21.000
Electrical machinery.—			
From Great Britain ...	30.43.000	26.57 000	— 3.86.000
„ Germany	64.000	27.000	— 37.000
„ Belgium	38.000	49.000	+ 11.000
„ Italy	68.000	1.99.000	+ 1.31.000
„ United States ...	2.92.000	2.28.000	— 64,000
„ Other countries ...	42.000	15.000	— 27.000
Total ...	35.47.000	31.75.000	— 3.72.000
Mining machinery.—			
From Great Britain ...	11.84.000	4.81.000	— 7.03.000
„ Germany	2.000	—	— 2.000
„ United States ...	50.000	2.19.000	+ 1.69.000
„ Other countries ...	—	37.000	+ 37.000
Total ...	12.36.000	7.37.000	— 4.99.000
Machinery, other (except textile and agricultural).—			
From Great Britain ...	1.87.08.000	1.51.00.000	—36.08.000
„ Germany	8.96.000	4.87.000	— 4.09.000
„ Belgium	9.54.000	2.29.000	— 7.25.000
„ United States ...	8.40.000	8.69.000	+ 29.000
„ Other countries ...	3.20.000	2.30.000	— 90.000
Total ...	**2.17.18.000**	**1.69.15.000**	**—48.03.000**
Railway carriages, &c.—			
From Great Britain ...	3.85.55.000	2.28.46.000	—1.57.09.000
„ Belgium	7.30.000	94.000	— 6.36.000
„ Other countries ...	65.000	44.000	— 21.000
Total ...	3.93.50.000	2.29.84.000	—1.63.66.000
Locomotives and tenders, and parts thereof.—			
From Great Britain ...	1.37.35.000	87.06.000	—50.29.000
„ Germany	24.000	13.000	— 11.000
„ Other countries ...	25.000	62.000	+ 37.000
Total ...	1.37.84.000	87.81.000	—50.03.000
Rails and fishplates.—			
From Great Britain ...	1.07.23.000	88.86.000	—18.37.000
„ Belgium	3.34.000	2.68.000	— 66.000
„ Other countries ...	2.32.000	3.93.000	+ 1.61.000
Total ...	1.12.89.000	95.47.000	—17.42.000
Glass lampware.—			
From Great Britain ...	91.000	1.38.000	+ 47.000
„ Germany	2.49.000	3.25.000	+ 76.000
„ Austria	2.29.000	2.75.000	+ 46.000
„ Other countries ...	93.000	1.34.000	+ 41.000
Total ...	6.62.000	8.72.000	+ 2.10.000
Electrical instruments, apparatus, &c.—			
From Great Britain ...	42.25.000	39.40.000	— 2.85.000
„ Germany	1.68.000	1.80.000	+ 12.000
„ Belgium	63.000	49.000	— 14.000
„ Austria	19.000	10.000	— 9.000
„ United States ...	80.000	1.29.000	+ 49.000
„ Other countries ...	27.000	39.000	+ 12.000
Total ...	45.82.000	43.47.000	— 2.35.000
Scientific, &c., instruments.—			
From Great Britain ...	15.17.000	12.15.000	— 3.02.000
„ Germany	1.02.000	74.000	— 28.000
„ United States ...	56.000	40.000	— 16.000
„ Other countries ...	1.48.000	82.000	— 66.000
Total ...	18.23.000	14.11.000	— 4.12.000
Telegraph construction materials.—			
From Great Britain ...	1.23.000	1.20.000	— 3.000
„ Other countries ...	8.000	—	— 8.000
Total ...	1.31.000	1.20.000	— 11.000

In addition to the foregoing, the following were imported as Government stores :—

	1908-9. Rupees.	1909-10. Rupees.	Increase or decrease. Rupees.
Instruments, apparatus, &c. (except musical).—			
From Great Britain ...	19.94.000	15.47.000	— 4.47.000
„ Germany	2.000	4.000	+ 2.000
„ United States ...	8.000	72.000	+ 64.000
„ Other countries ...	5.000	6.000	+ 1.000
Total ...	20.09.000	16.29.000	— 3.80.000
Machinery.—			
From Great Britain ...	37.21.000	27.53.000	— 9.68.000
„ Germany	54.000	2.000	— 52.000
„ United States ...	57.000	14.000	— 43.000
„ Other countries ...	2.000	4.000	+ 2.000
Total ...	38.34.000	27.73.000	—10.61.000
Iron wire.—			
From Great Britain ...	76.000	1.56.000	+ 80.000
Steel plates and sheets.—			
From Great Britain ...	7.20.000	6.67.000	— 53.000
„ United States ...	1.000	1.000	—
Total ...	7.21.000	6.68.000	— 53.000
Railway carriages.—			
From Great Britain ...	2.57.93.000	96.77.000	—1.61.16.000
„ Other countries ...	—	1.56.000	+ 1.56.000
Total ...	2.57.93.000	98.33.000	—1.59.60.000
Locomotives.—			
From Great Britain ...	1.10.44.000	87.56.000	—22.88.000
Rails and fishplates.—			
From Great Britain ...	37.59.000	59.83.000	+22.24.000
„ Canada	3.32.000	—	— 3.32.000
Total ...	40.91.000	59.83.000	+18.92.000
Telegraph construction materials.—			
From Great Britain ...	9.46.000	9.28.000	— 18.000
„ Belgium	4.000	3.000	— 1.000
„ United States ...	—	13.000	+ 13.000
„ Other countries ...	1.000	9.000	+ 8.000
Total ...	**9.51.000**	**9.53.000**	**+ 2.000**

THE THEORY AND PRACTICE OF WIRELESS DETECTORS AS AT PRESENT USED.

By S. M. POWELL.

(*Concluded from page* 13.)

Dimensions of Platinum Electrolytic Detectors.—The critical dimension in all electrolytic detectors is the exposed anode area. In certain of the Telefunken Co.'s detectors the anode is said to project into the electrolyte $\frac{1}{100}$ mm. and to be $\frac{1}{1000}$ mm. diameter, the remainder being waxed over. That such fine points are practicable is much to be doubted, and in many of his tests Branly used points 0·01, 0·02 and even 0·05 mm. diameter, and of negligible projection into the electrolyte. Eccles, in the case cited above, clearly assumes dimensions of the same order.

Characteristic Properties of the Electrolytic Detector.—This detector is very sensitive and very susceptible to accurate tuning. Its automatic decoherence and general character enables it to be used in wireless telephony, and it has been used thus in successful transmissions up to from 300 to 400 miles. Electrolytic detectors permit of such syntonic working, such accurate tuning and such loose coupling, that reception is impossible if the wave length is different, from that for which the receiving circuits are tuned, by more than $\pm 1\frac{1}{2}$ to 2 per cent.

Effect of Vibration.—Tapping electrolytic detectors increases their sensitivity somewhat as would be expected, depolarisation being thereby aided.

Effect of Bubbling Gas Through the Electrolyte.—A remarkable increase in the sensitivity of electrolytic detectors is observed if certain gases be bubbled through the electrolyte at a pressure of from 4 to 5 atmospheres (Branly).

Effect of Temperature.—Raising the temperature of electrolytic detectors apparently increases their sensibility, but to exactly what extent appears uncertain. Branly states a maximum sensibility at 60° C., less satisfactory results being obtained on both sides of this temperature. On the other hand, Abraham recommends 120° C. as a temperature at which sharper resonance is obtainable with about normal sensibility (Eiffel Tower tests). Raising the temperature to 120° C. lowers the resistance of an electrolytic detector from the order of thousands to the order of hundreds of ohms: the capacity simultaneously rises from a few hundredths to about half a microfarad. The improved results obtained at higher temperatures are probably mainly due to the lower resistance, and so less damping of the cell.

Variations of Electrolytic Detectors.—(1) Constructional and of connections; (2) Inherent.

(1) *Constructional Variations, &c.*—Abraham states that larger diameter electrodes may well be employed; the capacity of the cell is then increased, but the considerable reduction in resistance decreases the damping, and partially removes the objections to the electrolytic detector on the score of high resistance. Jégou suggests as a further constructional modification the use of two similar electrodes, both being of the anode construction. This course is objectionable since it increases the already high resistance of electrolytic detectors, forces up the critical voltage, and only gives in return the relatively unimportant advantage of independence of polarity, either electrode being capable of acting as anode. This result is obtained at less cost of efficiency, and with little loss of convenience, by the use of a reversing switch in the detector circuit. This is usually provided in any case, since different types of detectors prefer different current directions, and may even vary from day to day.* To avoid disturbance of the detector, and loss of time by reconnecting, a reversing switch is essential.

A means of overcoming the disadvantage of the high resistance of electrolytic detectors to a great extent is shown in fig. 3. This, the Gesellschaft für Drahtlöse Telegraphie arrangement, permits of much better syntony. The inductance 6, the variometer 8, and the condenser 7 form an oscillatory circuit capable of more or less close coupling with the aerial coil 3. The receiving telephone and battery are shunted across a condenser in series with the electrolytic detector. Preliminary tuning is by 2 and 4; then the coupling 3-6 having been weakened, 8 is increased and 7 decreased to obtain maximum effect at 9 and 11. Damping is controlled, roughly, by the proportion of the inductance 6 to the variometer inductance 8. The deterioration of resonance with the increase of resistance in the circuit is well shown by fig. 4.

(2) *Inherent Variations.*—These include the alteration of the material of the electrodes and of the electrolyte employed. The electrolyte used with a platinum anode may be any of various acids and alkalis, but dilute sulphuric acid apparently gives better results than any other single electrolyte. Jégou finds that the addition of a small quantity of fuming nitric acid to the sulphuric electrolyte reduces the critical voltage from 3·7 to 2·7, this being alone unimportant, but enabling very convenient operation if a graphite (lead pencil) cathode is also used in place of the platinum or gold generally employed. This substitution further reduces the critical voltage to 2 volts, and so enables the use of a single secondary cell direct connected instead of one or two cells and a potential divider (B, fig. 2).

A tantalum anode and any of the electrolytes used with platinum give results, still better than obtainable from a carborundum detector, but less satisfactory than obtainable with a platinum anode. Also tantalum is a less manageable metal than platinum, though it can be obtained in a fairly convenient form from glow lamps with tantalum filaments. There is no advantage to be gained by the use of tantalum in electrolytic detectors (see, however, Walter's Ta-Hg detector below).

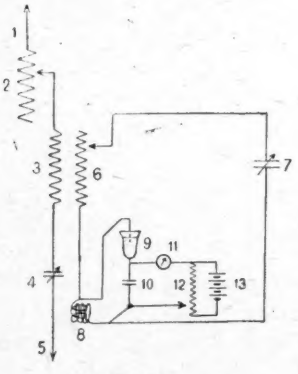


FIG. 3.

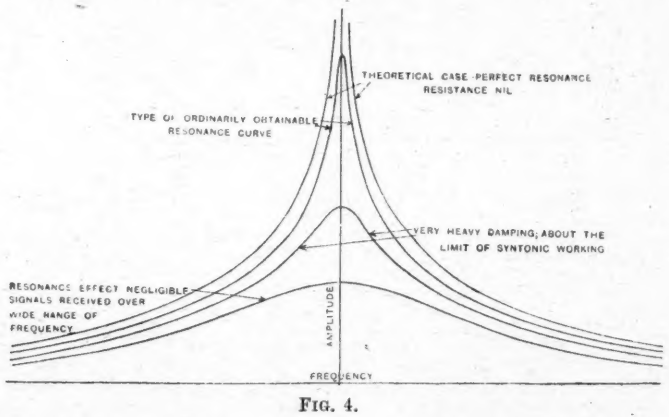


FIG. 4.

3. *Thermo-Electric Detectors.*—This type of detector consists of a very fine and adjustable contact between two dissimilar materials. The contact is so fine and of such high resistance that the heating effected at it, by the high-frequency oscillatory currents induced by the received electrostatic waves, sets up a thermo-electric current from the junction (by the Peltier effect) of sufficient strength to operate the receiving telephone. The higher the resistance of the junction (see Table I) the greater the heating for a

* The author is able to confirm this remarkable fact from his own observations.—S.M.P.

given current flow but the less this current for a given received train of waves. Relatively low contact resistance, maximum current flow and maximum thermo-electric E.M.F. are the desirable attributes of a thermo-detector which must further, as usual, be automatically self-restoring after operation.

Thermo-electric detectors must be carefully distinguished from the unilateral or "rectifier" detectors noted below, though the types are practically identical in construction; and in many cases the detector action is due to a combination of thermal and rectifying effects, while in a number of cases it is by no means certain whether the action should be considered thermal or rectifying. Experimental investigations into the matter are very difficult owing to the smallness and high frequency of the currents actually operating the detector in practice. It by no means follows that measurements made, as to the unilateral conductivity of a material, with direct current, are applicable to the material when traversed by high-frequency alternating currents. Further, it is not easy to make even direct-current conductivity measurements on many crystals owing to the difficulty of securing reliable electrical contact. Apparent unilateral conductivity frequently proves to be due to imperfect contact—the operation of the detector actually depending on thermal effects.

In general, more or less imperfect contacts between metals operate on the coherer principle or by thermo-electric action while crystalline metallic—and non-metallic—contacts may be thermal or rectifying, the action being possibly electrolytic to a certain extent in the latter case. Certain rectifying metallic pairs are mentioned in the next section.

In thermo-electric detectors the current may flow in the opposite direction to that in which thermo currents due to heating would flow, the detector action then being asymmetric.

Many pairs of materials are recommended by various experimenters as giving a satisfactory thermo-contact. In many of these, a metal figures as one material and some mineral, crystal, &c., as the other. Usually the mineral is split along its cleavage planes and one of the excellent surfaces so formed is used for the contact; amorphous material is seldom satisfactory as a detector electrode. Owing to slight differences in the composition of such crystals (the presence of impurities and so on), displacing the point of contact with the metal may vastly improve the action or worsen it as the case may be. Among the thermo-detectors at present known are:—*(a)* Red mineral zincite (zinc oxide) split across its cleavage planes and pressed against a piece of metal (say platinum)—(Pickard).

(*b*) Oxidised sharp edge of copper touching tin or bismuth and being spring adjusted (as in fig. 5) (Gesell. für Drahtlöse Telegraphie).

(*c*) Possibly some thermal action occurs between tellurium and aluminium arranged as below, though probably the action is mainly rectifying (Austin).

In Table I a further list of materials is appended, the order of the contact resistances in the various cases being as shown. These are very variable.

TABLE I.—THERMO DETECTOR COUPLES.

Materials.	Contact resistance ohms (approx.).	Authority.
"Perikon" detectors (without applied voltage)	25,000	Pickard.
Tellurium point—brass plate	10	C. Tissot.
Metal point—chalcopyrite	50 to 200	"
Platinum wire—chalcopyrite	1,200 to 1,500	"
Metal point—indigo—copper	1,500	"

(The mineral chalcopyrite referred to above is a double sulphide of iron and copper, found in Cornish mines, and having the composition two of copper; two of iron; four of sulphur, *i.e.*, $x\ [Cu_2\ Fe_2\ S_4]$).

Metallic sulphides in general, and galena in particular, appear to form satisfactory thermo-detectors if used in the natural crystalline form. Natural crystals are usually far more operative than artificial crystals, while the amorphous form is, as a rule, useless.

4. *Unilaterally Conducting or Solid Rectifying Detectors.*—These detectors form a very large and successful class, though thermo-detectors are probably more sensitive. The action simply consists in the rectification of the high-frequency currents induced by the received waves, the rectified impulses operating a telephone. Theoretically, no auxiliary E.M.F. is required with the detectors, but it is usual to provide a P.D. capable of fine regulation and reversal whereby to adjust the detector conditions till maximum sensitivity is attained. The applied E.M.F. is then such in direction and

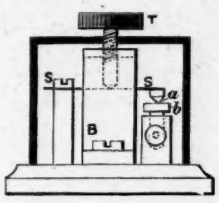


FIG. 5.

magnitude as to bring the conductivity of the rectifying contact to the steepest portion of its voltage-current (V-C) characteristic. The best possible rectification, and hence detector sensibility, is thus secured. Any material or device of any description showing unilateral conductivity, whether absolute or relative, can be used with more or less success as a wireless detector, but for best results a steep voltage-current curve is desirable. The vacuum detectors referred to below are operative solely on account of their rectifying properties.

Theory of Solid Rectifiers.—A perfect contact of very small area being a necessary condition in solid rectifier detectors, it is possible that the constriction of the current at the contact produces electronic impoverishment in the neighbouring non-metallic material, and hence the capability of rectifying A.C. (Pickard).

Fleming explains the action of crystal type rectifying detectors as being due to certain complex materials (*e.g.*, silicon carbide, titanium oxide) giving up electrons more freely at some parts of their surface and taking them in more freely at other parts. These spots act as outward and

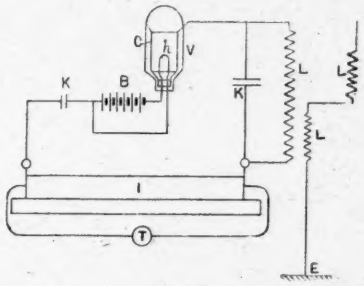


FIG. 6.

inward electric valves respectively. Were these distributed uniformly over the whole surface of the electrode, their net effect would be *nil*, but in certain crystals it is presumed that a concentration of "in" or "out" valves exists at the ends of the crystal, so giving an easy path to current in one direction, but offering great obstruction to current flow in the opposite sense. The rectifying property being explained, the action as a detector at once follows.

Materials for Rectifying Detectors.—Among the materials used are the following pairs, the arrangement of the contact pieces *a*, *b*, being usually, as already shown, for thermo-detectors (fig. 5) with spring adjustment S, T.

1. Perikon detectors—a rather wide class, classified by some experimenters as thermo-detectors, probably dependent partly on thermal, partly on rectifying action: Silicon, molybdenite and zinc oxide, chalcopyrite, the latter having the steepest characteristic.

2. Carborundum and many similar natural crystals are strongly unilateral in their conductivity, and act as excellent detectors if used with one of their natural crystal apices bearing on a metal plate (*e.g.*, platinum, tellurium).

3. Silicon and steel form a rectifying couple (Austin), the action being very definite between applied terminal potential differences of 0·02 volt and 0·2 volt. The currents within

TABLE II.—Comparing Various Types of "Detectors."

Type of detector.	Properties.												Suitable for what purposes.	Remarks, authorities, &c.
	Automatic decoherence.	Adjustability.	Tuning.	Quick acting.	Sensitivity. To weak signals.	Sensitivity. To strong signals.	Resistance.	External effects. Vibration.	External effects. Field.	Ease of construction and erection.	Ease of procuring material.	Total.	Quantitative in action or dependent on maximum P.D.	
Maxima ...	5	5	5	5	5	3	4	4	4	2	1	43		
Coherer... ...	0	0	3	5	4	3	2	5*	4	1	1	28	P.D.	Medium distance wireless telegraphy
Magnetic ...	5	3	4	4½	5	2	3	4	3½	1	1	36	P.D.	Long-distance telegraphy; shorter distance telephony
Electrolytic ...	5	3	5	5	5	3	2	4	4	2	1	39	Ct.	Long or short-distance telegraphy and telephony
Thermo-electric	5	5	4	4½	4½	3	3½	3	4	2	½	39	Ct.	Ditto, but less satisfactory for telephony
Ordinary "Rectifier"	5	5	4	5	2	2	2½	4	4	2	½	36	P.D.	Suitable for experimental telegraphy
Walter's Ta-Hg ditto	5	5	4	5	2	3	2½	4	4	2	1	37½	P.D.	Suitable for short-distance work or for exceptionally strong long-distance work
Selenium ...	3	4	2	2	4	3	2	3	4	0	½	27½	?	Not likely to be of great use
Vacuum "valves"	5	0	3	5	4½	3	2½	4	3½	0	1	31½	P.D.	Suitable for general work, but no advantage in using in preference to electrolytic or thermal

Personal experience (Maxima, Coherer, Magnetic, Electrolytic, Thermo-electric, Ordinary "Rectifier")

Walter, Eccles, Fessenden and others (Walter's Ta-Hg ditto)

No successful selenium detector yet known. Figures tentative (Selenium)

Fleming's results hardly confirmed by other investigators. (Vacuum "valves")

* Vibration is a very marked advantage in the case of coherers; hence the over-marking.

this range vary with the square of the alternating voltage applied. The current usually flows from steel to silicon, though instances have been found of an opposite occurrence.

4. Carbon-steel (Austin) forms a less perfect rectifier than (3).

5. Tellurium-Aluminium.—A knife edge of tellurium pressed on a rotating aluminium rod by a suitable spring forms a rectifying detector which is not very satisfactory in operation, though strongly unilateral to direct current. Rectified alternating currents in this case flow in the same direction as the thermal current if less than 0·5 volt is

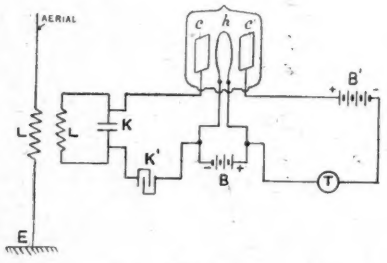


Fig. 7.

applied to the detector, and in the opposite direction if more than 0·5 volt be applied. The relative importance of thermal and rectifying effects in this case is a moot point.

In silicon-steel and carbon-steel detectors the rectified alternating current flows in the opposite sense to the thermal current; such opposition necessarily reduces the efficiency of the detector somewhat.

A very interesting recent form of rectifying detector which has been much discussed is Walter's

Tantalum-Mercury Rectifier.—A tantalum wire about 0·05 mm. diameter, say a piece of tantalum lamp filament, just dips into the surface of a pool of mercury, which, according to Eccles, should not be too clean. The tantalum may be clamped to a platinum lead and contact made to the mercury by a platinum lead fused through the glass container. The detector is unanimously reported to have a sensibility of from eight to ten times that of any other known detector so long as the signals received are above a certain strength. Below this critical value the detector, like most rectifying receivers, is useless, though thermal and electrolytic types may still easily receive the signals. Within the range of its suitability the Walter detector acts very regularly and needs no enclosure from the air, &c. Fessenden finds more energy to be available in the telephone circuit than is received in the electromagnetic signal waves when using this detector and for signals above the critical strength. This action and the existence of a critical strength of signal he takes to indicate the existence of a skin, probably of nitride or oxide, to which the detector action is due.

Above the critical strength of signal the superior loudness and purity of tone of the tantalum mercury detector make it preferable to the electrolytic type for wireless telephony. Though tantalum will exhibit these properties when in contact with other metals, mercury gives by far the best results, and this is the only known couple in which it is preferable to use tantalum rather than platinum. Permanent coherence appears to be impossible between tantalum and mercury, whereas tantalum used with other metals gives detectors which are less sensitive and not so perfectly autodecohering.

Several surmises as to the exact theory of the tantalum-mercury detector have been already noted. A further suggestion, by Fleming, is that the action is due to the mercury not wetting the tantalum. This opinion finds confirmation in the extreme importance of using mercury as one electrode, but does not explain the advantage of tantalum over platinum and similar metals. Probably the latter is due to some such skin effect as that suggested by Eccles.

5. *Vacuum Detectors, "Oscillation" Valves or "Audion" Valves.*—That such devices are merely vacuous rectifiers has been already mentioned. The fact on which they depend is that observed many years ago by Fleming, viz., that if a heated filament and a cold insulated electrode be enclosed in a vacuous space, electric currents can pass through the space from the hot to the cold electrode, but not *vice versâ*. In Fleming's "oscillation valve" utilising this fact, the rectified currents passed directly through the receiving telephone, but two recent improvements (figs. 6 and 7), introduce the important principle of using a condenser in the oscillatory circuit as shown, so that the rectified current cannot flow round the oscillatory circuit, but accumulates in the condenser till the latter discharges, when the whole current flows through the inductorium I (fig. 6), in whose primary is the telephone T, or directly through the telephone T (fig. 7), as the case may be. The use of the transformer I (fig. 6) is equivalent to a high-resistance telephone receiver (which is advantageous owing to the low current taken to produce given A T). The de Forest arrangement (fig. 7) uses two cold electrodes, one

each for the oscillatory circuit and the telephone circuit, instead of one common cold electrode. The introduction of the condenser in the oscillatory circuit is, however, the important improvement (Eccles). The improved audion valves (figs. 6 and 7), though a considerable advance on the simple Fleming oscillation valve, are still inferior to thermo detectors.

6. *Selenium Detectors.*—The phenomena of the light sensitivity of selenium are well-known and strongly-pronounced, and there seems no doubt that selenium is affected to a certain extent by electromagnetic and electrostatic waves, as well as by certain other invisible radiations. There is thus a possibility of a successful selenium detector being evolved, though such is not yet available.

Conclusion.—The order of sensibility of detectors recently quoted by Fleming (May, 1909), viz. :—Oscillation valve, magnetic detector, electrolytic and carborundum is by no means exhaustive or even universally true, so far as it goes, The writer's experience agrees rather with the order :—Thermal, electrolytic, magnetic and rectifying types, the "audion" sensibility being variable, but probably between that of the electrolytic and magnetic types, under the most favourable conditions. The impracticability of dogmatically enunciating an order of merit for the many forms of receivers now available has been explained, and the accompanying table (Table II) probably represents the best means of comparing different types. From Table II the probable suitability of any of the types of detector referred to for any given purpose may be estimated. The table, though far from exhaustive, indicates the chief characteristics of each type, and the purposes for which it is best suited.

The system of marking in Table II is self-explanatory, the maxima being proportioned to the importance of the property in question. The scheme is not complete, one of the important omissions being that of durability, which is, however, an attribute very dependent on chance, and one regarding which it is yet too early to express a definite opinion. Probably the scale of durability will commence : magnetic type, electrolytic type, audion valves, and may continue : coherer, thermo-electric and rectifier types.

The marks awarded to selenium detectors are, of course, quite hypothetical and based on our present knowledge of the properties of selenium. Certainly a selenium detector would have to be kept in the dark, and would be subject to considerable damping and inertia lag with no obvious compensating advantages.

ERRATUM.—Lines 49-52, col. 1, p. 12, should read as follows :—Imperfect contact detectors in general, in which the variations of the contact resistance produce the desired signals, are pressure operated ; while electrolytic and thermo-detectors of the crystal type are current operated. . . .

REVIEWS.

Solenoids, Electromagnets and Electromagnetic Windings. By CHARLES R. UNDERHILL. London : Constable and Co., Ltd. Price 8s. net.

As the author observes in his preface, there is a distinct need for more published information as to the design and behaviour of "electromagnets"—a term which he employs chiefly to indicate operating electromagnets intended for actuating a movable core or armature.

Probably most manufacturers of switchgear operated by electromagnetic devices have their own experimental data as to the best proportions to be adopted for a given pull on the plunger and a given length of stroke. They have not shown much readiness, however, in making the results of their tests public. It is for presenting us with the records of a number of systematic tests carried out on electromagnets of various types that Mr. Underhill deserves our thanks. There is no doubt that the data and curves which he has reproduced in the book before us will be found useful by many practical designers when in search of experimentally-obtained results. Mr. Underhill tells us that the tests which he describes have occupied a long period, and he appears to have made practical use of the results by embodying them in the designs for apparatus of various types.

Those chapters which deal with the experimentally obtained data, and the formulæ which the author deduces from them, are numbered 5 to 9 and 12. In Chapter 12 are also given some results of experiments already published by Mr. D. L. Lindquist in the *Electrical World* on electromagnets for polyphase circuits. The remaining chapters are devoted to the elements of electromagnetic theory, and to the consideration of materials used in electromagnets, and of magnet windings. We cannot help regretting that when giving us the six chapters based on his experiments, Mr. Underhill was not content to omit the remaining 15. He is not happy when dealing with theory, and the windings for magnets are treated adequately in numerous books on general design. Also a large proportion of the tables and curves given towards the end of the book have little value for the British reader, since they are based on the Brown and Sharpe wire gauge in use in America.

In the portion of the book which we have described as likely to prove of real value, the author obtains, by means of simple approximate calculation, expressions for the strength of the field along the axes of solenoids of various shapes. He then proceeds to show by experiment that the force which acts upon a saturated plunger inserted into the solenoid is roughly that due to a field having the strength calculated in this way. Then follow a number of test curves showing the actual pull found on the plunger inserted in solenoids of various dimensions, the effect of the position of the plunger on the pull, the variation of pull with current strength, &c. Later, follow experiments made with solenoids provided with both fixed and movable plungers and with external iron circuits, as well as tests on the effect of a conical-ended plunger. There comes next a very slight consideration of magnets with external armatures, which include lifting magnets and polarised relays.

The material furnished by the author in the chapters thus summarised may be turned to good account by the designer who is able to interpret the results for himself, and to use the author's formulæ with discrimination. There are, however, so few indications given as to the numerous approximations made in deriving the formulæ, and hardly any guides as to the limits within which the assumptions are permissible, that the novice in search of information regarding designs of a type outside those actually cited might easily be misled.

A chapter on alternating-current electromagnets, again, contains some interesting curves, and a rather inadequate analysis of the results as a guide in practical design.

Having dealt with that part of the book which we think likely to prove of most value, we feel compelled to protest against the inclusion of a number of chapters dealing only with general elementary principles of electricity and magnetism, in a book which professes to be written about electromagnets and solenoids. There might have been some justification for including this introductory matter, if it had been truly introductory : that is, if it had been clearly and concisely arranged to enable the reader to trace the theory of the solenoid and electromagnet from first principles. Unfortunately, the treatment is neither clear nor systematically arranged for this purpose. The student who approaches the study of the solenoid without a knowledge of Ohm's law, will be well advised to turn for instruction to some standard text-book, where he will find such matters given with greater clearness and accuracy than in the chapters which Mr. Underhill devotes to them.

The author's style leaves much to be desired. Not only is the grammatical construction of his sentences often at fault, but the sequence of thought is frequently confused. One or two extracts will illustrate both of these failings. On page 19 occurs the statement : "It is also evident that where two or more conductors of different conductivities, and particularly if of the same cross-section, form part of the same electric circuit, the greater part of the E.M.F. will be expended in overcoming the resistance of the conductor having the lowest value for γ (conductivity). It will also be evident that, for constant E.M.F., the conductor having the

greater conductivity will have the greater density of current when singly connected."

As another example, we may quote the following paragraph from page 185 : "When an electromagnet is connected in a circuit, the phenomenon of inductance tends, upon rupturing the circuit, to increase the total E.M.F., thus producing an abnormal flow of current momentarily. This principle is in common use in electric ignition apparatus, and explains why so large a spark cannot be obtained when a very short contact is made as may be obtained with a longer duration of contact."

In dealing with the principles of alternating currents, the author becomes confused between the voltage of self-induction and the applied voltage overcoming it. This leads him to make a mistake in drawing the diagram on page 158. It does not add to clearness of ideas to speak of "resistance due to self-induction" or of "resistance due to capacity," as the author does in the same chapter. However, we have said enough to show that Mr. Underhill is not an infallible guide in matters of theory, or of literary style.

The external appearance of an otherwise well-got-up book is marred by a rather ludicrous misprint in the title, as given on the back. The subject there appears as "Solenoid's Electromagnets and Electromagnet Windings." The book-binder ought really to be informed that Mr. Solenoid has given up keeping electromagnets since the introduction of the last Budget.

Alternating Current Machinery. By William Esty, S.B., M.A., Head of Department of Electrical Engineering, Lehigh University. Published by the American School of Correspondence. 1909. London : Crosby Lockwood and Son. Price 12s. 6d. net.

The reviewer had already seen some of the volumes issued by this School of Correspondence, and been favourably impressed by the methods of treatment, the illustration and the general get up. The contents of this one are quite good, and in marked contrast to some of the text-books for a similar purpose that he has seen.

Mr. Esty is one of America's really able young men—the kind that America keeps at home because they are good. For it is only fair to state that the young American electrical engineers should not be judged by the half-baked cocksure specimens that were crowded on to us a few years back.

Mr. Esty has managed to cover the whole subject in a little over 400 pages, without any mathematics beyond the simplest trigonometry. Further, the reader is only assumed to have an acquaintance with the simpler laws of electricity and magnetism.

Abstract and arbitrary statements have been reduced to a minimum, and a large variety of examples and numerical illustrations have been used to reinforce the principles by concrete applications.

Nothing is too small to notice ; for example, minute directions are given for accurately reading the dials of integrating wattmeters. This, by the way, is not so simple as it looks ; in fact, the liability of error makes one wish makers could get away from the multitude of small dials. They remind one too much of a gas meter.

The analogies are particularly well put, and are probably such as Mr. Esty uses in his own lecture room ; thus : The hunting of a synchronous motor is a phenomenon of the same nature as the hunting of a steam engine having an over-sensitised governor. When the load on the engine is suddenly increased, the engine slows down momentarily, causing the governor to admit more steam than is needed for the increased load. The result is that the engine quickly speeds up, causing the over-sensitive governor to shut off too much steam, so that the engine slows down again, and so on.

An illustration is given of a portion of the revolving field of an alternator showing the copper dampers, consisting of rectangular frames driven into place under the overhanging tips of two adjacent poles. These were formerly used by the Bullock Electric Manufacturing Co., but they have now abandoned the design, as the construction of their alternators is such as to render them unnecessary.

It is interesting to recall that the effect of these dampers was discovered accidentally on some fly-wheel alternators built in the early days by Messrs. J. Fowler & Co., Leeds. They were put on to hold the field coils in place, and then it was found that they improved parallel operation.

The Scott three-phase, two-phase transformation is explained, and the statement made that for long-distance transmission three-phase is universally adopted, but that for local distribution of power the two-phase system offers certain advantages. Then the case of the Niagara-Buffalo transmission is given as the most extensive example of this practice. Eleven 5,000-H.P. two-phase alternators generate at 2,200 volts in the Niagara power house. The energy is stepped-up to 22,000 volts, and at the same time changed to three-phase. At the Buffalo end of the three-phase line it is stepped down again to 2,200 volts two-phase, and at that pressure distributed to consumers. No mention is made of the very extensive use of this method throughout California. The 1,000 odd miles of 60,000-volt three-phase bus-bars or transmission lines connecting the various hydro-electric power houses are tapped at intervals by three-phase two-phase transformers.

The very interesting constant-current transformer with a moving coil is described, and magnetic flux lines are shown to indicate how the voltage is automatically changed by the pull and push on the moving coil. This piece of apparatus for arc lighting deserves to be better known in this country than it is. The reviewer has seen some fine arc lighting installations in the Colonies on this system. The transformer is very sensitive, and at the same time a really well-designed and constructed piece of apparatus.

It may be an accident, but there is one very serious fault in the volume before the writer, namely, that the index does not fit the volume at all. It seems to have slipped in from some previous edition. Anyone purchasing the book, therefore, should see to it that the correct index is bound in.

One hears occasionally of offers of marriage being found in barrels of apples from Canada. This book has a pencil note across two of the pages which must have been written before the sheets were bound together, to the effect that the Misses Rose and Kate Spaulding (twins, age 18), of 114, Ampersee Av., Kalamazoo, Mich., U.S.A., wish to correspond with anyone having black hair and dark eyes.

The intimation is appropriately written across paragraphs dealing with "The Operation of Alternators in Parallel" and "Conditions necessary for Parallel Operation." If anything comes of this intimation, the least the brides can do is to send the editors and reviewer some of the wedding cake.—E. K. S.

NOTES ON THE POSITION IN SOUTH AMERICA.

(*Continued from page* 6.)

The Progress of Argentina.

Farther south, Argentina continues to boom, and British money is being poured thereinto by the million sterling. There is room there for almost unlimited enterprise on the part of engineers, and it does us good to make a close investigation of our own position in relation to the country as frequently as we can. British engineering firms recognised the importance of the field to the full when the Buenos Ayres Railway Exhibition was arranged last year, and according to reports none of them has any reason to regret the time, trouble and expense devoted to giving adequate representation of their manufactures. Mr. Percy F. Martin, who acted as the South American correspondent of the *Railway Gazette*, reported many months ago that not only were the actual exhibits sold, but a better hold altogether on the market was obtained as the result of exhibiting. The British exhibit was a good one, some 250 firms taking part, and our list of awards far overtopped those of our competitors. It will be remembered that the doors were several months late in opening, yet Mr. Martin, writing in July, said that with the exception of certain exhibits of raw material in the shape of iron, steel and alloy metals,

practically every exhibit in the British Section had found a purchaser, while some exhibitors had booked valuable forward orders. It may be reasonably imagined that if in the early days this was the experience, the later months must have brought much more grist to the mill. Potential buyers were there from practically all the other Latin-American States, besides the Argentine, and naturally British firms made many valuable connections among these for future trade. We hope that the electrical firms were as successful as any others who took advantage of the opportunity. We have no regret for having urged the Exhibition upon our readers' notice in the early days of its organisation.

Trade Methods in Argentina.

In a recent report on the trade of Argentina, the Austrian Consul-General at Buenos Ayres makes some valuable comments concerning the best methods of doing business, and the means to be adopted to protect trade interests. He states that it is very necessary that the trade mark of goods to be imported should be registered in the country, and that this registration should be effected through a trustworthy and well-known agent, even if the fees are higher than those charged by the lesser men.

Great care should be taken in the question of advertising goods, and a regular insertion of advertisements in the most important daily and trade papers cannot be too strongly recommended. Many papers quote a small rate for regular advertisements, with the result that in the end the cost is not much more than that of inserting advertisements at intervals. If advertisement placards are sent, it is very necessary that they should be drawn up in Spanish, otherwise they can be of very little value. The most useful advertising medium is the calendar form capable of being hung up. As regards posters for the streets, they should be large and elegantly drawn up, such as are exhibited in the largest towns in the world; small posters pass almost unnoticed. Another very useful medium of advertisement in Argentina is that of the brilliantly coloured enamelled iron plate. For good advertisement of this character expenses are often very heavy. Catalogues sent in languages other than Spanish are valueless and are often never even read. Firms wishing to extend their business should endeavour to get into direct touch with the Argentine merchants, as the latter are particularly desirous of buying their goods at the source, and direct correspondence often leads to continued relations with buyers; this is particularly true of Buenos Ayres. In the provincial towns conditions are slightly different. There are in the interior several large and wealthy firms, but it is not usually convenient to deal with them direct as they are a long way distant from the port of discharge and are not in daily contact with the large banks, whilst the large importer of Buenos Ayres has connections not only with the whole of Argentina, but also with Uruguay, Paraguay, and Bolivia, and has his own branches in the more important centres. If firms, however, are particularly desirous of dealing with the provincial firms direct they should remember that the latter are in a great degree dependent on the harvests and are not therefore always so capable of paying quickly. As regards terms of payment it may be said that payment, wholly or partly, for goods before shipment or *loco* factory, is now almost done away with. The financial standing and reliability of the Argentine merchant is now generally recognised, and he is therefore now in a position to demand treatment equal to that accorded to large and reliable firms in any market of the world. The usual conditions are payment from three to four months; payment with from 2 to 3 per cent. discount against documents is little used now.

The extension of trade in the Argentine is best effected by means of agents, and in Buenos Ayres particularly it is customary that such agents should be in a position to give rebates, price concessions, &c., to settle differences, and generally to act with full power of the company on their own authority. The greatest care should be taken in the choice of such an agent, as it is not easy to find agents reliable enough to be trusted with these powers. In executing orders for the Argentine the greatest care should be taken that the stipulations of customers are complied with; this is particularly the case in the matter of packing, quality and reliability of the goods. Badly or poorly-packed goods are easily spoiled, and are often returned by the customer, particularly in cases where overland transport is necessary. The European buying houses are strongly established in the market, and do their best to secure trade with the Argentine merchants. They import all kinds of goods, purchased by their home houses, keep large stocks, and send home samples of any goods which are likely to secure a footing in the market. It is consequently necessary that individual exporters wishing to trade direct and not through the large buying houses, should send travellers at frequent intervals to examine the changes of conditions in the market.

Sir John Benn's Investigation.

Among other literature that has been placed in our hands lately regarding Argentina are reports of two very spirited and telling addresses that have been delivered to commercial and industrial men in this country by Sir J. W. Benn, who witnessed the Centenary Celebrations there last year. Sir John was only there six weeks, so he did not attempt to talk in his addresses to the London or Glasgow Chambers of Commerce as an expert—he merely gave impressions obtained in the course of personal contact with the country, its business men, and so forth. Nevertheless, we venture to think that some of his remarks are worthy of attention, as in his capacity as a journalist investigating trading possibilities, he is probably on safer ground than when he adopts the *rôle* of electric traction critic. In the course of his six weeks, as Sir John told the members of the London Chamber of Commerce, he visited, among other places, Bahia Blanca, the Liverpool of the Argentine; Mendoza, the great wine-growing district; the wonderful snow-clad Andes; old Cordoba and the mountains beyond; Rosario, the growing port of the river Parana; La Plata, the city of culture which has yet to "arrive," and many of the camp towns lying between these centres of population. He said that only those who had fallen under the spell of South America by personal contact could realise the true value of the adjectives which he employed.

Among the first questions of those inquiring about the Argentine are: "Is the Government stable? Is its present prosperity likely to be permanent? Is the British investment in railways and general commerce justified? Are we losing our share of the Argentine market, and if so, how can we keep it? What are the openings for further British trade in the country?"

To such questions as these Sir John replied in a speech, parts of which we abstract below:—

Outside the comparatively narrow circle of those who know the Argentine from personal inspection, the impression prevails that it is still a semi-savage land of revolvers, knives and revolutions. These pessimists think that justice and good government are uncertain, and that all investments, at the best, must be risky. My observations on the spot have certainly placed me among the optimists. As to the Government, my best answer to critics would be that it is no better and no worse than many which serve for countries which boast an older civilisation and in regard to which investors have no qualms. The recent Centenario entitles the Argentine to a full certificate for civilisation. Those celebrations showed, not only marvellous development, but a stability and restraint of the population affording the best evidence of settled and efficient administration.

Argentina is a country five and a half times the area of France, and its population and prosperity have increased by leaps and bounds. It has now a population of seven millions, but it has space and natural resources that will carry seventy. Revolutions are, I believe, a thing of the past.

The first sight of the Argentina capital takes "one's breath away." The phrase "The Paris of South America," is no misnomer. In 40 years Buenos Ayres, which now covers twice the area of Paris, has increased its population sevenfold to the million and a quarter of to-day. The death-rate is about the same as that of London.

Adorning its thousand streets are hundreds of buildings which may well be described as palaces, devoted to national and local government, universities, colleges, schools, museums, public libraries, hospitals and charitable institutions. The place, if one may say so, reeks with money, and the observer who fails to examine the hinterland may have some excuse in thinking that such prosperity is of exotic growth and cannot possibly last.

Apart from the wheat, the meat, the wool and the hides, I inspected the wine, the sugar and the timber industries, and came unhesitatingly to the conclusion that stately Buenos Ayres was but the natural expression of great national resources.

Such natural wealth is comparatively valueless without adequate means of communication with the rest of the world. It is when one sees a sample of the 16,000 miles of railways that anxiety on this score ceases. Some far-seeing Britishers—all honour to them—recognised the future of Argentine railways, and were first in the field with well-equipped lines, constructed almost entirely of British material, starting from Buenos Ayres and stretching their tentacles far into the interior. The wealth, in natural resources, is there in abundance. Without the railways it cannot be turned into money, and so they must prosper.

In the five years from 1904 o 1908, the passengers carried on Argentine railways have doubled, being 47,000,000, against 23,000,000. The tonnage of goods conveyed in 1908 was 32,000,000, as against 20,000,000 in 1904, and the profits show an increase of 10,000,000 gold pesos.

There are now about 3 miles of railway for every thousand inhabitants. The Argentine is thus in the proud position of fourth in the list of the world's railways. This is due almost entirely to our enterprise and money. British capital is represented by about 130 millions of pounds, French by 8 millions, and Argentine, for the State railways, by 16 millions. There are four of five leading companies, all British. The "Great Southern," representing nearly 3,000 miles of lines, under the able management of Mr. Percy Clark, takes front rank as a line property. It covers the southern part of the province of Buenos Ayres for some 500 miles, between the capital and the coming port of Bahia Blanca. There it has, together with the "Buenos Ayres and Pacifis," well-equipped docks and grain elevators. It draws its large business from a settled and fruitful country, and is rapidly opening up in the district of the

River Neuguen and the Rio Negro Valley, a territory of great promise.

The Buenos Ayres and Pacific holds the blue ribbon of Argentine railways, because it has at last linked up the South Atlantic and Pacific Oceans. By wise union with the "North Western," the B.A.P. is also splendidly installed at Bahia Blanca, with moles and the latest corn elevators, and thus provides outlet for the largely undeveloped wheat-growing plains which I saw between Bahia Blanca and Mendoza. By this fine route the B.A.P. taps and assists the lines of other companies which run from east to west. Its main line is the one by which I travelled from Buenos Ayres to Los Andres in Chile, a distance of some 800 miles. By the tunnel which pierces the summit of the Andes, a through route is provided, not only between the Argentine and Chile, but between the southern seas.

Another leading line is the Central Argentine, an admirable broad gauge railway of some 3,000 miles, and which is now extending another 600. I travelled over it to Cordoba and the mountains beyond, and was delighted with all I saw. Serving as it does the growing city and port of Rosario, so well placed on the River Parana, and also the provinces of Cordoba and Santa Fé, it commands huge territories, rich in increasing and varied produce. Not only corn and cattle, but the sugar of Tucuman and the axe-breaking timber quebracho of the northern forests, come within the network of Central Argentine and its connections. Mr. Pearson is the responsible chief.

Did time permit, other railways, such as the Buenos Ayres Western, some 1,300 miles long, the North-East Argentine, about 600 miles, and the standard gauge groups known as the Entre Rios, North-Eastern and Paraguay Central Extension, would call for favourable comment.

The British name is also honourably associated with several great insurance companies and banks. The Argentine owes much to their steadying influence and high standard of finance. With regard to banks, foreign financiers with easier terms and ways relieve our establishments of much business. Indeed, I think that more adaptability to Argentine methods might, without undue risk, increase our bank dividends.

But there is one Argentine phrase which constitutes an unrivalled testimonial to the probity of our country. If a bargain is made which must be above suspicion, it is made "on the word of an Englishman." That phrase in Spanish stands as the gold standard in Argentine business morals.

In regard to general commerce, the Britisher has also had his share of business. The question is: "Is he keeping it?"

The imports to the Argentine mainly consist of supplies for the needs of its army of railway, wheat and meat producers and their employés. Sixty per cent. of those imports represent agricultural implements, building and railway material, coal, and last, but not least, clothing for the workers. A few years ago the Britisher distanced all competitors, but latterly the German and the Frenchman have taken an increasing share of the business. Here are the figures for a recent period of 10 years supplied by Mr. Carnegie Ross, C.B., our excellent Consul at Buenos Ayres:—

ARGENTINE IMPORTS.

	1899. Per cent.	1908. Per cent.
Britain	37·5	34·2
Germany	11·1	15·2
Italy	11·8	9·6
U.S.A.	13·2	13·1
France	9·4	10·6

It will be seen that we have dropped 3 per cent. in our trade while Germany has increased 4 per cent. and France 1 per cent. The U.S.A. returns remain stationary, while Italy has receded 2 per cent. There is no great cause for alarm in these figures, because, in total, we are still doing more than we ever did, but there certainly is reason for inquiry. What accounts for the set-back in the British figures?

I do not join with the critics who delight to speak of the general stupidity of the Britisher and his refusal to adapt himself either to the wishes or the currency of his foreign customer. Our best houses in Buenos Ayres are as well equipped for local conditions as any others. But, at the same time, it is clear that the German traveller, or agent, gets an advantage over us in several ways: as linguist, as an adept in the arts of giving customers what they want instead of what they ought to want, and also of combining finance with trading, not only with regard to credit but in the form of inducements to subordinates to place business. If our Secret Commissions Act were put in force in the Argentine some of our competitors would lose much of their business.

Further, longer credit and lower prices—not necessarily better value—can often be obtained. The working population is largely Spanish or Italian, and they will put up with cheap and nasty soft goods, as long as they are showy and of qualities which British manufacturers do not care to touch. But the vendor of the inferior article gets the order, and so up go his returns.

These foreign competitors "hustle" much more than we do. Their diplomatic representatives show an interest in commerce which would shock the well-bred Minister. And so occasionally large orders are mysteriously placed in unlikely quarters. Warships go to the United States, great electricity and lighting contracts go to the Germans, dock and harbour works go to the French, and our figures are reduced 4 per cent. The wonder is that in the midst of all these influences they are so well maintained.

Another reason why our trade does not go ahead is due to the doubt in the mind of the British merchant and manufacturer. "South America, you know, is very speculative," is a phrase one often hears. This attitude appears curious, perhaps stupid, when compared with that of the Stock Exchange. A glance at the records and the stock and share list will show that our monied people have placed in various ways some five hundred million sterling in the Argentine, a large portion of which has been expended in British material on this side. They show no qualms about the safety of their money, or the interest to be earned. If our traders showed like courage they would, I am sure, reap a larger reward. It seems a pity that we should run ships and build railways to facilitate the trade of our competitors when we might be carrying more of our own goods. We cannot, perhaps, do everything, but let us do as much as we can.

The merchant or manufacturer who would cultivate trade in the Argentine—and it is well worth doing—must bear in mind certain first principles. He must be represented by men who can speak the language or languages, of Argentine buyers. The young German there gets into a business house as a distributor. His linguistic abilities soon secure his advancement, and he takes care to divert all the business he can into German channels. The Britisher as distributor has been a diminishing number. He has rather figured as the big importer. The details of the distributor or shopkeeper are often beneath his notice, and so another, the German "importer," is let into that establishment. And this is the more regrettable because all other things being equal, there is a prejudice in favour of British goods. They have a reputation, like our word of honour.

To secure a continuity of business it is imperative to see that quotations, invoices, weights and measurements, are all rendered in the Argentine equivalents. We lose many orders because we have not the brains to adopt the decimal system. The requirements of the Customs, too, must be carefully studied, and met with civility and skill. To get goods through successfully is quite as important as getting orders for them.

And another word as to credit. If the customer is sound—and the banks can protect their friends—it is well to remember that in a country where capital is wanted, and the great word is *manana* (to-morrow), some elastic must be put into the rigidly-fixed British pay day. I am sure that many foreign firms get business because they combine a little money-lending with ordinary trade. And they take care to charge for the accommodation.

As to the goods supplied, it is of great moment to supply what the people really want. A careful collection of the things most in vogue, with the report of a competent agent on the spot, is the best safeguard for successful business. To tell the Argentine "These are our goods, take them or leave them," is bad policy.

Some business men may say "All this means worry and delay." At first it may, but a margin of price can generally be secured to pay for it, and in any case it is our duty, as patriotic business men for the sake of our country, and those who come after us, to get and retain our foreign trade wherever possible.

To manufacturers and merchants I would say their chances of trade are wider and more varied. I noticed that many shopkeepers in the Argentine announce "goods in the English style," whether they have them or not. If they are approached with the right articles they will buy and pay well, for there is no lack of money. Turning to the camp, the manufacturer has another wide field open in dealing direct with the "estanciero." The proprietors of these camp communities have a way of buying direct most of the things which they require, from their guns to their carriages and agricultural implements. These, together with the inevitable general camp store, become valuable customers when once confidence is established and the difficulties of the Customs are overcome. The sales of appliances to assist the industries of the country are enormous, but a special knowledge is required as to what best suits Argentine needs. There is but little analogy with our agriculture. It is a study of these conditions which has secured orders for so much Yankee machinery. It must be remembered that many of these Argentine farmers have suddenly jumped into the position of British squires and landed proprietors. They are building better houses which want furnishings, pictures, and gas (and *electric*, Editors E.R.) fittings. Such luxuries as the motor-car are greatly in demand in the cities.

Passing from goods to persons, I may be asked, "What is the chance in the Argentine for the young man who desires to better himself or make a future?" My answer is, that any young man with brains and energy, who will master Argentine Spanish, adding, if possible, French and Italian, must do well. The country is a good place for workers, but bad for shirkers. If the young man has money to back him, let him graduate in the country before he parts with it. "A fool and his money soon part," in the Argentine. The young bachelor had better make his position before he takes out a wife. A man can rough it, but to keep a refined woman in any sort of comfort is costly. To the ordinary type of British emigrant—the man who has only unskilled labour to offer—I say, "Don't go." The Italian and Spaniard hold the labour field. They can thrive under open-air conditions, and with food which seems impossible to the ordinary English emigrant.

With the skilled artisan it is different, but he finds it difficult to work cheek by jowl with the Italian or Spaniard, and generally soon becomes a "boss."

Commenting upon the British success at the International Railway and Land Transport Exhibition, Sir John Benn said that that fine display completely eclipsed the rival efforts of our competitors. Germany, the United States, Italy, and other countries were well in evidence, but the British exhibit not only was twice the size of any other, but was the best collection ever shown of appliances for haulage, railways, and means of communication. All honour was due to the great railways, the engine and carriage builders, and the shipping firms, motor makers, and many manufacturers of locomotive acces-

saries who came forward at very short notice and made this section an unqualified success.

The Exhibition revealed at every corner the great opportunity which still remains open to us for placing in this great country more of our money, energies and manufactures. "We do not want to patronise this young Republic for which we have already done so much. Argentines properly loathe any such attitude. But if we cordially recognise it as one of the foremost nations of the world, inclined for many reasons to regard Britain as 'the most favoured nation,' we shall still secure a great extension of abiding commercial interests."

(*To be continued.*)

CREOSOTE TREATMENT FOR POLES.*

BY GEORGE R. OGIER.

THE process used at our Norrie plant is what is known as the "open tank" process. The apparatus consists of three storage tanks, supported upon a platform high enough to allow the creosote to run by gravity into two treating tanks, one circular 10 ft. in diameter and 9 ft. high, and a rectangular tank, 12 ft. long, 4 ft. wide and 8 ft. deep. By the use of a derrick the treating tanks are loaded, oil is allowed to enter to a height in the tank sufficient to creosote the pole to the height stated in the specifications, which is about 6 ft. from the butt on a 25-ft. pole, treating all the buried end of the pole and to about 1 ft. above ground. The creosote around the pole is now heated to a temperature sufficient to open the pores in the wood and expel most of the air by expansion, thus forming a partial vacuum. This condition is now relieved by turning off the steam, and thereby stopping the hot bath. The hot oil is replaced by cool oil, which penetrates the pole while cooling is taking place. The duration of this cool bath is made sufficient to give the desired penetration for about a 20-year service.

The theory of the above process may be given in a few words: The heat of the preservative expands and expels a portion of the air and water contained in the cellular and inter-cellular spaces of the wood tissue, and when the cool creosote replaces the hot there is a contraction and condensation of the air and water which remains. To destroy the partial vacuum thus formed the liquid is forced by atmospheric pressure into the cellular and inter-cellular spaces, a process aided, of course, by capillary attraction.

The ease and effectiveness with which timber can be treated by this process depend upon the kind of wood, and whether it is seasoned or unseasoned. Air is easier expelled than water, and in our native Lodgepole pine timber there is very little moisture, it being fire-killed timber and therefore absorbing the preservatives more readily than green timber.

The following is a table of data compiled by the United States Government showing the comparative life of untreated and treated poles:—

	Average number of years untreated life.	Average number of years treated life est. by F.S.
Cedar	12 to 15	25
Chestnut	8 to 10	20
Lodgepole pine	5	20
Western yellow pine	6	25
Cypress	12	25
Juniper	10 to 13	25
Redwood	12 to 15	30
White oak	8	20
Douglas fir	8	20

Some of the above data is estimated from test lines put in by the United States Government in co-operation with the American Telephone and Telegraph Co. in November, 1906.

The best available figures on the life of creosoted poles are from the German Postal and Telegraph Department, which, after 52 years of observation, gives a life of 21 years for creosoted Baltic pine. The use of creosote for preserving timber has been shown by the experience of the English and French lines, to be beyond question a method which absolutely protects those parts injected with it. Creosote prevents that effect shown by intermittent wet and dry, and makes the timber waterproof.

One of the greatest advantages of creosote treatment for timber is that not only does it lengthen the life of timbers, but it makes the life of all kinds of timber practically the same, so far as decay is concerned.

The following table shows the estimated annual financial saving by a proper preservative treatment of poles:—

				Years of life.		Annual charge.				
Material.	Placed.	Total.	Cost foot.	Untreated.	Treated.	Untreated.	Treated.	Annual saving.	Quantity in use.	Total amount saving.
$4.00	$3.00	$7.00	$1.50	13	23¼	$0.78	$0.69	$0.09	32,000,000	$2,880,000

* Abstract of paper read at eighth annual convention, Colorado Electric Light, Power and Railway Association.

This table was figured from averages by the following formula:—

$$a = p \frac{1.0\ r^n \times 0.0\ r}{1.0\ r^n - 1},$$

a = annual charge, p = investment, n = years in recurring period, r = interest on investment at 6 per cent.

In many cases the consumers require in their specifications, poles of larger diameter than the actual service requires, in order that a certain amount of deterioration by decay shall be allowable before replacement is necessary. For example, it is computed that a circumference of not less than 28 in. of sound wood in the pole at the ground line is required to support the strain to which the line is liable to be subjected, and the poles used have a circumference of 36 in. at the ground line; then 8 in. of deterioration, or the equivalent of a depth of decay of approximately 1¼ in., is allowable before replacement is required.

In some species otherwise durable, the sapwood decays very quickly. Untreated white cedar poles in Georgia, inspected after being set in line four years, showed 45 to 50 per cent. of the number with sapwood completely decayed at the ground line, which amounted to an average deterioration of 4 in. in the circumference, equivalent to an average depth of decay of fully ⅝ in. Cypress poles in Florida, inspected after being in the ground seven years, showed an average depth of decay of 0·8 in. at the ground line. The heartwood of these poles is sound, and in nearly all cases is of sufficient dimensions to meet the requirements of the line in which they are used, although graded by the butt circumference they fall decidedly lower than their original class. If poles, originally of the same grade represented by these poles after the sapwood has decayed, had been used, and the butts well treated with creosote so that their full size and strength would be maintained, not only would the poles be equally as strong as the ones now in use, but their ultimate life would be greater. The difference in cost between the two grades of poles in some cases would largely offset the cost of the treatment. It appears that pole users are paying money to secure large diameter sizes of poles in order to secure longer life, that might more profitably be spent for preservative treatment. The possibility of using lighter poles and giving them preservative treatment so as to maintain their full size and strength, is one that merits the attention of all pole users.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SPAIN.

(*Concluded from page* 39.)

The following duties are payable:—

	Pes.
Dynamos, electro-motors, induction coils, resistance boxes, transformers, governors, switchboards and cut-outs, weighing:	
Up to 400 kilogs., and component parts ...	75 per 100 kg
401 to 2,500 kilogs.	37·50 „ „
2,501 to 5,000 kilogs.	30 „ „
5,001 kilogs. and upwards	20 „ „
N.B.—Accessory parts such as slide plates, bed plates, foundation plates, bolts, &c., are to be dutiable under this heading if imported separately, the weight of the accessory not being added to the weight of the apparatus if forming part of the same shipment.	
Accumulators and electric cells, and component parts of the same	25 „ „
Arc lamps, and parts, except carbons	2 per kg.
Carbons for arc lamps	1 „
Apparatus for telegraphs and telephones, electric meters and the like, including separate parts for the same	2 „
Incandescent lamp bulbs:	
With mounting	8 „
Without mounting	10 „
Insulating articles of mica or micanite, or of asbestos, for electro-technical purposes ...	25 per 100 kg.
Wire of copper, bronze or brass, without any covering of textile fibres:	
Of a thickness of 1 to 10 mm. inclusive ...	28·50 „ „
„ „ less than 1 mm.	30 „ „
Cable and wire for the conduction of electricity, covered with textile fibres, with or without insulating materials, the total thickness being 1 cm. or more	45 „ „
Other cables and wire less than 1 cm. thick ...	120 „ „
Iron and steel rails weighing 25 kg. or more per metre	4·20 „ „
Iron and steel rails weighing less than 25 kg. per metre and grooved rails for tramways ...	5·60 „ „
Iron and steel wheels for tramway carriages, whether mounted on axles or not	13 „ „
Iron and steel wire more than 5 mm. thick, of any section:	
Not polished nor dipped in other metals ...	7 „ „
Polished or dipped in other base metals ...	10 „ „

	Pes.		
Iron and steel wire 1 mm. or more, but not more than 5 mm. thick, whether polished or dipped in other base metals or not	11	per 100 kg.	
Iron and steel wire less than 1 mm. thick ...	15	„	„
Steam and gas engines, fixed, without boilers or fly-wheels, and separate parts for the same, weighing :—			
Up to 10,000 kg.	35	„	„
From 10,001 kg. to 25,000 kg....	30	„	„
25,001 kg. and upwards	20	„	„
Steam generators, cylindrical, including steam boilers not mentioned elsewhere	15	„	„
Boilers, multitubular, gasogenes, and separate parts for the same...	20	„	„
Steam and gas engines, semi-fixed, with their boilers; petrol, compressed air, and other similar engines, and separate parts for the same, except fly-wheels	40	„	„
Fly-wheels for motor machinery of all kinds ...	12	„	„
Cranes, fixed and floating (*flotantes*), and separate parts for the same...	20	„	„
Pumps of all kinds, and separate parts for the same, except fly-wheels	25	„	„
N.B.—Motors for working pumps, even if imported together with the pumps, are to pay duty separately according to kind.			
Machinery and apparatus of copper and its alloys, for use in industries	80	„	„
Machinery not specially mentioned in the Tariff	22	„	„
Mica in sheets or worked, even combined with other materials	70	„	„
Asbestos, unmanufactured	1·50	„	„
In sheets, with or without admixture of other materials	20	„	„
Manufactured into machine packing, tissues or other articles with or without admixture of other materisls	45	„	„
Tramway carriages for passengers with or without motor	75	„	„

N.B.—Duties are payable in gold (25 gold pesetas = £1).

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

30,047. "Improvements in joints for telegraphs, telephone, electric transmission poles and the like." H. J. CLARKE. December 28th.

30,058. "Transportable electric vacuum cleaner, which can also be used as a blower." P. A. FISKER. (Date applied for under Sec. 91 of the Act, January 6th, 1910, being date of application in Denmark.) December 28th. (Complete.)

30,075. "Improvements in or relating to magnetic cranes." STEEL, PEECH AND TOZER, LTD., and H. E. BOWEN. December 28th.

30,114. "Improvements in or relating to electric alternating-current systems." A. REYROLLE and H. W. CLOTHIER. December 28th.

30,138. "Improvements in and relating to electric rail-bonds." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) December 28th. (Complete.)

30,166. "Magneto generator." F. W. GOLBY. (Draper Latham Magneto Co., United States.) December 29th. (Complete.)

30,167. "Magneto generator." F. W. GOLBY. (Draper Latham Magneto Co., United States.) December 29th. (Complete.)

30,169. "New or improved apparatus for pickling and electro-plating small articles." S. O. COWPER-COLES. December 29th.

30,176. "Automatic electric illuminated and timed advertising cabinet." J. J. TANNER. December 29th.

30,178. "Improvements in and relating to electric cigar and pipe lighters." T. H. WILLIAMS. December 29th.

30,180. "Improved adjustable shade-holder for shades for electric, gas, oil, or candle illuminant." H. HIRST and F. T. CASH. December 29th.

30,194. "Improvements in and apparatus for the electrical purification of gases." J. Y. JOHNSON. (Badische Anilin & Soda Fabrik, Germany.) December 29th.

30,201. "Improved means for regulating electrical heating apparatus." W. E. TRUMPLER. (Date applied for under Sec. 91 of the Act, January 10th, 1910, being date of application in Switzerland.) December 29th. (Complete.)

30,217. "Improvements in electrically-controlled elevators." T. G. MASON. December 29th.

30,220. "Improvements in continuous-current generators." W. CHUDZIKOWSKI. December 29th.

30,233. "Improvements in and relating to dynamo-electric machines." BRITISH THOMSON-HOUSTON CO. (General Electric Co., United States.) December 29th.

30,237. "Improvements in machines for simultaneously writing a plurality of signatures or inscriptions." C. K. MILLS. (Signature Co., United States.) December 29th. (Complete.)

30,240. "Improvements in trolleys for trolley-poles of electric railway cars." R. D. BLACKSTONE. December 30th.

30,254. "Improved mercury vapour electric lamp." J. S. ANDERSON and G. B. BURNSIDE. December 30th.

30,263. "Improved holder for flexible insulated electric wires or cords particularly adapted for use with table and like electric lamps." H. F. MARRIOTT. December 30th.

30,297. "Improvements in electricity motor meters of the mercury type." COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATERIAL D'USINES A GAZ. (Date applied for under Sec. 91 of the Act, May 2nd, 1910, being date of application in France.) December 30th. (Complete.)

30,313. "Improvements in hand spikes for making electrical connections." EVERSHED & VIGNOLES, LTD., AND S. EVERSHED. December 30th. (Complete.)

30,319. "Improvements in flaming arc lamps." J. L. DINSMOOR. December 30th. (Complete.)

30,323. "Improvements in supports for electric incandescent lamp filaments." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) December 30th.

30,324. "Improvements in supports for electric incandescent lamp filaments." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) December 30th.

30,343. "Improvements in or relating to portable electric cluster lamps." F. KIRBY. December 31st.

30,382. "Improvements in and relating to electric switches or cut-outs." J. E. OLVIS. December 31st.

30,390. "Improvements in electric furnaces." V. POPP. (Date applied for under Sec. 91 of the Act, May 6th, 1910, being date of application in France.) December 31st. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

ELECTRIC CURRENT LEAKAGE INDICATORS. J. P. Winn. 28,480. December 6th. (Request under Sec. 19 of the Act not granted.)

ELECTRIC HEATERS FOR LIQUIDS. W. G. van Loon. 28,684. December 7th.

ELECTRIC CONTROL GEAR. Clarke, Chapman & Co. and R. C. Harris. 29,004. December 11th.

ELECTRICALLY ILLUMINATED ADVERTISING SIGN. Gates. 29,437. December 18th.

AUTOMATIC SWITCHES AND CIRCUIT-BREAKERS. H. R. Schultz. 30,185. December 24th.

1910.

SEARCHLIGHTS OR PROJECTORS. Siemens Bros. Dynamo Works. (Siemens-Schuckertwerke Ges.) 8,507. April 8th.

COVERS FOR ELECTRIC-MAGNETIC RELAYS. G. H. Nash and Western Electric Co. 9,071. April 14th.

MANUFACTURE OF ELECTRODES FOR ACCUMULATORS. A. T. K. Estelle. 9,964. April 23rd. (Date applied for under International Convention, May 18th, 1909.)

CONTROLLERS FOR ALTERNATING-CURRENT ELECTRIC MOTORS. Adams Manufacturing Co. (Cutler-Hammer Manufacturing Co.) 11,904. May 18th.

DRIVING RAILWAY CARRIAGE LIGHTING DYNAMOS. A. A. Crawford. 12,690. May 25th.

AUXILIARY TELEPHONE RECEIVER. W. Schwarzhaupt. 12,739. May 25th.

ELECTRICAL CONDUIT FITTINGS AND THE ACCESSORIES FOR SAME. C. E. Gunner. 12,903. May 27th. (Date applied for under Rule 13, November 29th, 1909.)

ARRANGEMENTS FOR CONTROLLING THE SPEED OF INDUCTION ELECTRIC MOTORS. Siemens Bros. Dynamo Works. (Siemens-Schuckertwerke Ges.) 17,731. July 26th.

SPARK-PLUGS FOR INTERNAL-COMBUSTION ENGINES AND OTHER PURPOSES. L. B. Cherry. 17,745. July 26th. (Date applied for under International Convention, January 17th, 1910.)

ELECTRICAL MERCURY-VAPOUR APPARATUS. W. Heraeus and H. Heraeus. 19,563. August 20th. (Date applied for under Rule 13, May 26th, 1910.)

ELECTROLYTIC MANUFACTURE OF ALKALI METALS AND ALLOYS OF ALKALI METALS. G. W. Johnson. (R. J. McNitt.) 20,519. September 2nd.

ELECTRIC LIGHT FITTINGS, SPECIALLY APPLICABLE TO BULKHEAD FITTINGS. A. L. Lind. 1,076. January 15th.

ELECTRIC SIGNALLING MECHANISM. G. K. B. Elphinstone. 1,484. January 20th.

ARRANGEMENT OFELECTRODES FOR THE ELECTROLYTIC REFINING OF METALS. F. M. Kohler. 2,864. January 31st.

SYSTEM FOR PREVENTING SHAFT VOLTAGES OR BEARING CURRENTS IN DYNAMO-ELECTRIC MACHINES. Felten & Guilleaume Lahmeyerwerke Akt.-Ges. 7,463. March 24th. (Date applied for under International Convention, April 27th, 1909.)

ELECTRIC ARC LAMPS. H. W. Lake. (W. F. Clark, U.S.A.) 10,943 and 10,955. May 3rd.

ELECTROMAGNETIC DEVICES. H. J. Boult. (W. H. Crowdus.) 13,662. June 6th

ELECTRIC REPULSION MOTORS. R. Biber. 15,014. June 22nd.

COMPOSITE MAGNETS. A. Keller-Dorian. 16,367. July 8th.

PREPAYMENT ELECTRICITY METERS. W. S. Sprague and Chamberlain and Hookham, Ltd. 17,415. July 22nd. (Request under Sec. 19 of the Act not granted.)

MANUFACTURE OF METAL-FILAMENT ELECTRIC LAMPS. Bergmann Elektricitäts Werke Akt.-Ges. 21,326. September 24th. (Date applied for under International Convention, December 18th, 1909.)

MEANS FOR THE ELECTRICAL TRANSMISSION OF SIGNALS. M. Arnold. 23,044 October 4th.

CONSTRUCTION OF COILS FOR ELECTRICAL APPARATUS. Firm of Robert Bosch 25,008. October 27th. (Date applied for under International Convention May 19th, 1910.)

Sunderland District Tramwaymen.—A meeting of district tramwaymen was held in the club room on Saturday midnight, Chief-Inspector Craggs presiding. Sick club matters were dealt with. The hon. secretary, Mr. C. Fox, presented his annual report showing receipts amounting to £130, expenditure £119, balance in hand £11. It was pointed out that this had been an exceptionally bad year, chiefly through serious illnesses lasting several weeks, and resulting in one case, in the death of a member. The new year began with practically the same number of members. A club doctor is to be appointed.

A meeting of Recreation Club members took place later, Mr. Craggs being again in the chair. The hon. secretary, Mr. J. Richardson presented his annual report, showing receipts £98, expenses £84, balance in hand £14. The chairman stated that during the last year a debt of £23 on the billiard table had been paid, the club room had been renovated, and other heavy items of expense had been met. It was decided that as soon as possible a start should be made with a set of bath-rooms and a café adjoining the club room.